

PROJECT MANUAL

MTECH

Cosmetology College

Red Bridge Station Lot #7

Payson, Utah 84651

Bid Set

May 12, 2025

NJRA Project Number: 24715.00



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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

(Name and location or address)

THE OWNER:

(Name, legal status and address)

THE ARCHITECT:

(Name, legal status and address)

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.



AIA[®] Document A701[™] – 2018

Instructions to Bidders

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

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

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

TABLE OF ARTICLES

1	DEFINITIONS
2	BIDDER'S REPRESENTATIONS
3	BIDDING DOCUMENTS
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6	POST-BID INFORMATION
7	PERFORMANCE BOND AND PAYMENT BOND
8	ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

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

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

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

ARTICLE 1 DEFINITIONS

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

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

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

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

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

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

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

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

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

ARTICLE 2 BIDDER'S REPRESENTATIONS

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

- .1 the Bidder has read and understands the Bidding Documents;
- .2 the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- .3 the Bid complies with the Bidding Documents;
- .4 the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- .5 the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- .6 the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

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

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

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

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

§ 3.2 Modification or Interpretation of Bidding Documents

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

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

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

§ 3.3 Substitutions

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

§ 3.3.2 Substitution Process

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

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

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

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

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

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

§ 3.4 Addenda

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

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

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

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

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

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

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

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

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

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

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

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

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

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

§ 4.2 Bid Security

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

(Insert the form and amount of bid security.)

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

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

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

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

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

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

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

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

§ 4.4 Modification or Withdrawal of Bid

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

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

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

(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

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

§ 5.2 Rejection of Bids

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

§ 5.3 Acceptance of Bid (Award)

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

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

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

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

§ 6.2 Owner's Financial Capability

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

§ 6.3 Submittals

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

- .1 a designation of the Work to be performed with the Bidder's own forces;
- .2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and
- .3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

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

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

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

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

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

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

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

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

§ 7.2 Time of Delivery and Form of Bonds

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

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

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

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

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

- .1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)
- .4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013.)
- .5 Drawings

	Number	Title	Date	
.6	Specifications			
	Section	Title	Date	Pages
.7	Addenda:			
	Number	Date	Pages	
.8	Other Exhibits:			
	<i>(Check all boxes that apply and include appropriate information identifying the exhibit where required.)</i>			
	<input type="checkbox"/>	AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below: <i>(Insert the date of the E204-2017.)</i>		
	<input type="checkbox"/>	The Sustainability Plan:		
		Title	Date	Pages
	<input type="checkbox"/>	Supplementary and other Conditions of the Contract:		
		Document	Title	Date Pages
.9	Other documents listed below:			
	<i>(List here any additional documents that are intended to form part of the Proposed Contract Documents.)</i>			

Application and Certificate for Payment

TO OWNER:	PROJECT:	APPLICATION NO: 001	Distribution to:
		PERIOD TO:	OWNER: <input type="checkbox"/>
FROM	VIA	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
CONTRACTOR:	ARCHITECT:	CONTRACT DATE:	CONTRACTOR: <input type="checkbox"/>
		PROJECT NOS: / /	FIELD: <input type="checkbox"/>
			OTHER: <input type="checkbox"/>

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	\$0.00
2. NET CHANGE BY CHANGE ORDERS	\$0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	\$0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	\$0.00
5. RETAINAGE:	
a. 0 % of Completed Work (Column D + E on G703)	\$0.00
b. 0 % of Stored Material (Column F on G703)	\$0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	\$0.00
6. TOTAL EARNED LESS RETAINAGE	\$0.00
(Line 4 Less Line 5 Total)	
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT	\$0.00
(Line 6 from prior Certificate)	
8. CURRENT PAYMENT DUE	\$0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	\$0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$0.00	\$0.00
Total approved this Month	\$0.00	\$0.00
TOTALS	\$0.00	\$0.00
NET CHANGES by Change Order		\$0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of: _____

County of: _____

Subscribed and sworn to before
me this _____ day of _____

Notary Public:

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.



Continuation Sheet

AIA Document, G702™–1992, Application and Certification for Payment, or G736™–2009, Project Application and Project Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.

In tabulations below, amounts are in US dollars.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:

001

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

[illegible]



AIA[®] Document G704[™] – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*

CONTRACT INFORMATION:

Contract For:

Date:

CERTIFICATE INFORMATION:

Certificate Number: 001

Date:

OWNER: *(name and address)*

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Work identified below has been reviewed and found, to the Architect's best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.

(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE OF SUBSTANTIAL COMPLETION

WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:

(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

OWNER *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE



AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

STATE OF:
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G707[™] – 1994

Consent Of Surety to Final Payment

PROJECT: <i>(Name and address)</i>	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i>	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the
(Insert name and address of Surety)

on bond of
(Insert name and address of Contractor)

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall
not relieve the Surety of any of its obligations to
(Insert name and address of Owner)

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:
(Insert in writing the month followed by the numeric date and year.)

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Work by Owner.
 - 4. Access to site.

1.3 PROJECT INFORMATION

- A. Project Identification: MTECH, Cosmetology College
 - 1. Project Location: Red Bridge Station Lot #7, Payson, UT 84651
- B. Owner: Blaine Turner
 - 1. Owner's Representative: Sheila Michaelis
- C. Architect: NJRA Architects, 5272 South College Dr., Suite 104, Murray, UT 84123

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work is defined by the Contract Documents and consists of the following:
 - 1. Construction of a new technical higher education school building (2-story building) and associated site improvements as shown in the Contract Documents.
 - 2. Construction of mechanical, plumbing, electrical, and structural systems to support the new building as shown in the Contract Documents.
 - 3. Construction of site elements including surface parking lots, driveways, walkways, landscaping, irrigation, site utilities, and retaining wall systems, as shown in the Contract Documents.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before existing building demolition begins.
 - 1. Environmental Cleanup of existing building and site.

1.6 ACCESS TO SITE

- A. Use of Site: Contractor shall have unlimited use of Project site for construction operations after the following owner items are complete:
 - 1. Owner approval and notice to proceed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 2100 "Allowances" for products selected under an allowance.
 - 2. Section 01 2300 "Alternates" for products selected under an alternate.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

- c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

1.7 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Substitution request is fully documented and properly submitted.
 - c. Requested substitution will not adversely affect Contractor's construction schedule.
 - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - e. Requested substitution is compatible with other portions of the Work.
 - f. Requested substitution has been coordinated with other portions of the Work.
 - g. Requested substitution provides specified warranty.

- B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

- 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Substitution request is fully documented and properly submitted.
 - e. Requested substitution will not adversely affect Contractor's construction schedule.
 - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - g. Requested substitution is compatible with other portions of the Work.
 - h. Requested substitution has been coordinated with other portions of the Work.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

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 specifies administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. (Proposals not taken through to the Architect, and implemented, will result in a non-payment/non-approved status).

1. *Proposal Requests issued by Architect are for information only.* Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within **7 days** after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate delivery charges, equipment rental, and amounts of trade discounts.
 4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 or Architect's standard form for Proposal Requests.
- D. Allowable Mark-Up: For a Proposed Change Order (PCO) of any amount, the allowance for the combined overhead, profit, and related bond costs included in the total cost to owner shall be as follows:
1. For Subcontractor (at any tier), the maximum amount shall be 10% of the total cost of all materials and labor associated with the change in the work.
 2. For General Contractor, the maximum amount shall be 5% of the total cost received from the Subcontractor for changes in the work.
 - a. Markup for the General Contractor and Subcontractors' combined total shall not exceed the 15 percent, as stated above.
 - b. Additional costs of supervision and field office personnel, and processing of documentation of the change is considered to be part of general conditions and is not attributable to the change.
 - c. In order to facilitate checking of the quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in a manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also.
 - d. Include a request for additional working days to complete the work. The "working day" shall be defined as any calendar day except Saturday, Sunday, and legal holidays at the project site.
- 1.5 CHANGE ORDER PROCEDURES
- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or Architect's standard form.
- 1.6 CONSTRUCTION CHANGE DIRECTIVE
- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used).

END OF SECTION 01 2600

SECTION 01 2900 - PAYMENT PROCEDURES

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 specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Submit draft of AIA Document G703 Continuation Sheets.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Progress payments shall be submitted to Architect by the 10th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. Contractor's Construction Schedule (preliminary if not final).
 - 2. Submittals Schedule (preliminary if not final).
- G. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
 - 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
- H. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. Evidence of completion of Project closeout requirements.
 - 2. Updated final statement, accounting for final changes to the Contract Sum.
 - 3. AIA Document G707, "Consent of Surety to Final Payment."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

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 administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Administrative and supervisory personnel.
 - 2. Project meetings.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's Construction Schedule.
 - 2. Delivery and processing of submittals.
 - 3. Progress meetings.
 - 4. Preinstallation conferences.
 - 5. Project closeout activities.
 - 6. Startup and adjustment of systems.

1.4 SUBMITTALS

- A. Key Personnel Names: Within 30 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Architect shall record significant discussions and agreements achieved, distribute the meeting minutes to everyone concerned, including Owner and Contractor, prior to the date of the subsequent meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
- C. Progress Meetings: Conduct progress meetings at regular intervals.
1. Minutes: Architect shall record and distribute to Contractor and Owner the meeting minutes.
 2. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 013110 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 FIELD MEASUREMENTS AND EXISTING CONDITIONS

- A. Contractor Responsibility: Exact field measurements are responsibility of the Contractor. Any required off-sets, additional fittings, re-routing of existing or new work to provide serviceable system within the location shown, and to maintain head room and clearances to match existing construction, are responsibility of the Contractor.
- B. Layout of the Work: The Contractor shall employ, at the Contractor's own expense, Registered Civil Engineer or Licensed Land Surveyor. Contractor's engineer or surveyor will provide layout of the work of the Project and establish all reference points and elevations required for construction.

1.2 GRADES, LINES AND LEVELS

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
- C. Benchmarks: Establish and maintain a minimum of six permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Preservation: All stakes, boundary lines, bench marks or survey marks, etc., which have been or may be established in any part of the Project site or adjacent thereto shall be carefully preserved and respected by the Contractor and shall be restored at the Contractor's expense if lost or destroyed as result of the Contractor's operations.
 - 1. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- E. Conflict: The Contractor will be held responsible for correctness of layout, for

establishing location of existing concealed utility lines, and for notifying the Architect in writing in event of conflict with the Drawings. In such case, the Contractor shall not proceed until instructed by the Architect.

- F. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, plumbness and elevations of construction and sitework.
- G. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.

END OF SECTION

SECTION 01 3200 - CONSTRUCTION PROGRESS DOCUMENTATION

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 administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Preliminary Construction Schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Submittals Schedule.
 - 4. Daily construction reports.
 - 5. Field condition reports.
 - 6. Special reports.

1.3 SUBMITTALS

- A. Submittals Schedule: Submit two printed copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Specification Section number and title.
 - 3. Submittal category (action or informational).
 - 4. Name of subcontractor.
 - 5. Description of the Work covered.
 - 6. Scheduled date for Architect's final release or approval.
- B. Preliminary Construction Schedule: Submit two printed copies.
- C. Contractor's Construction Schedule: Submit two printed copies of initial schedule: one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
- D. Field Condition Reports: Submit one copy immediately at time of discovery of differing conditions.
- E. Special Reports: Submit one copy immediately at time of unusual event.

1.4 QUALITY ASSURANCE

- A. Pre-scheduling Conference: Prior to commencement of construction activities conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the Preliminary Construction Schedule and Contractor's Construction Schedule, including, but not limited to, the following:

1. Discuss constraints, including phasing and storage areas.
2. Review time required for review of submittals and re-submittals.
3. Review requirements for tests and inspections by independent testing and inspecting agencies, If required
4. Review time required for completion and startup procedures.
5. Review and finalize list of construction activities to be included in schedule.
6. Review submittal requirements and procedures.
7. Review procedures for updating schedule.

1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work including delivery of equipment from parties involved.
 2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 2. Initial Submittal: Submit concurrently with preliminary construction schedule. Include critical submittals required as soon as possible following commencement of the work. List those required to maintain orderly progress of the Work and those required early because of excessive lead-time for manufacture or fabrication.
 - a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for commencement of the Work or the Notice to Proceed to date of Substantial Completion.

- C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 2. Submittal Review Time: Include review and re-submittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 3. Startup and Testing Time: Include days for startup and testing as required by the Electrical Consultant.
 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase or separate areas of the work,
 2. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Uninterruptible services.
 - c. Use of premises restrictions.
 - d. Provisions for future construction.
 - e. Seasonal variations.
 - f. Environmental control.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards, if any.
 - b. Submittals.
 - c. Purchases.
 - d. Fabrication.
 - e. Sample testing.
 - f. Deliveries.
 - g. Installation.
 - h. Tests and inspections.
 - i. Adjusting.
 - j. Startup and placement into final use and operation.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, Percentage completion milestones and Final Completion.
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require 1 month or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site, if any.
 - 2. List of separate contractors at Project site where applicable
 - 3. Approximate count of personnel at Project site.
 - 4. High and low temperatures and general weather conditions.
 - 5. Accidents.
 - 6. Meetings and significant decisions.
 - 7. Unusual events (refer to special reports).
 - 8. Stoppages, delays, shortages, and losses.
 - 9. Emergency procedures.
 - 10. Orders and requests of authorities having jurisdiction.
 - 11. Change Orders received and implemented.
 - 12. Construction Change Directives received.
 - 13. Services connected and disconnected.
 - 14. Equipment or system tests and startups.
 - 15. Partial Completions.
 - 16. Substantial Completions.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List a chain of events, persons participating, a response by the Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one day before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to the Architect, Owner, sub-contractors, testing and inspecting agencies, if applicable and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 3200

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.3 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings or REVIT files may be provided by Architect for Contractor's use in preparing submittals. General contractor shall submit request on behalf of themselves or sub-contractors.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- C. Submittals Schedule: Contractor shall process all Project submittals including Samples for Initial Selection as described herein and deliver to architect within **90 calendar days** after the date of Notice to Proceed or **90 calendar days** after date of the Preconstruction Conference and Commencement of Construction Activities, whichever occurs earlier. The Contractor shall pay directly to the Owner a penalty of \$200 for each submittal for every calendar day after the ninety days have elapsed.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Resubmittal Review: Allow 15 days for review of each resubmittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name and address of Contractor.

- e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
1. Use for Construction: Use only final submittals with mark indicating "Approval notation from Architect's action stamp".

1.4 SUBMITTAL FORMAT

- A. PDF Submittals: Prepare submittals as PDF package, incorporating complete information for each submittal into ONE PDF file. Name PDF file with submittal name and number (matching the corresponding specification section).
- B. Samples (as listed in 2.1.D below) are required to be submitted as physical samples of materials and color options. PDF's with images of materials and colors will not be approved.
- C. Paper Submittals:
- 1. If requested (or necessary) provide submittal in paper format in lieu of PDF format. Place a permanent label or title block on each submittal item for identification; include name of firm or entity that prepared submittal.
 - 2. Provide a space on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 - 3. Action Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect will return two copies.
 - 4. Informational Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect will return two copies.
 - 5. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - 6. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Mark each copy of each submittal to show which products and options are applicable.
 2. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Standard product operation and maintenance manuals.
 - g. Compliance with specified referenced standards.
 3. Submit Product Data concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Schedules.
 - h. Design calculations.
 - i. Compliance with specified standards.
 - j. Relationship to adjoining construction clearly indicated.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 42 inches (750 by 1000 mm).
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample set; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Certificates and Certifications: Provide a notarized statement that includes signature of Contractor, testing agency, or design professional responsible for preparing certification. All certificates and certifications must be signed by an authorized officer or other individual authorized to sign documents on behalf of the company.
 - 2. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Requirements."
- B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- D. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.

- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- J. Pre-construction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- K. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- L. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- M. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements in Division 1 Section "Closeout Procedures."
- O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable.
- P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or

equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- Q. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- R. Material Safety Data Sheets: Submit information directly to Owner. If submitted to Architect, Architect will not review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp or provide Architect's Standard Letter of Review, and will mark appropriately to indicate action taken.

END OF SECTION 01 3330

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

- D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Laboratory Mockups: Full-size physical assemblies constructed and tested at testing facility to verify performance characteristics.
 2. Integrated Exterior Mockups: Mockups of the exterior envelope constructed on-site as freestanding temporary built elements consisting of multiple products, assemblies, and subassemblies, with cutaways enabling inspection of concealed portions of the Work.
 - a. Include each system, assembly, component, and part of the exterior wall to be constructed for the Project. Colors of components shall be those selected by the Architect for use in the Project.
 3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes; doors; windows; millwork; casework; specialties; furnishings and equipment; and lighting.
 4. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 5. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work

and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.4 DELEGATED-DESIGN SERVICES

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

1.5 CONFLICTING REQUIREMENTS

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

1.6 ACTION SUBMITTALS

- A. Mockup Shop Drawings: For integrated exterior mockups.
 - 1. Include plans, sections, elevations, and details, indicating materials and size of mockup construction.
 - 2. Indicate manufacturer and model number of individual components.
 - 3. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.7 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.8 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days from Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - 1. Project quality-control manager may also serve as Project superintendent shall not have other Project responsibilities.

- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.9 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.

- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.10 QUALITY ASSURANCE

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

engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
 - 1. Provide test specimens representative of proposed products and construction.
 - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 - 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 - 5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
 - 6. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
 3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 5. Demonstrate the proposed range of aesthetic effects and workmanship.
 6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 10. Demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved Shop Drawings and as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.
- M. Room Mockups: Construct room mockups according to approved Shop Drawings and as indicated on Drawings, incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.

1.11 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Payment for these services will be made from testing and inspection allowances specified in Section 01 2100 "Allowances," as authorized by Change Orders.
 3. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.

- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
 - 1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
 - 2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.12 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "Execution."
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 4000

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost.
- B. Water Service: Pay water service use charges for water used by all entities for construction operations.
- C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 3. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
- H. Traffic Controls: Comply with requirements of authorities having jurisdiction.
 - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
 - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- I. Parking: Provide temporary parking areas for construction personnel.

- J. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
 - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
 - 2. Remove snow and ice as required to minimize accumulations.
- K. Project Identification and Temporary Signs: Provide Project identification sign. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
- L. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Execution Requirements" for progress cleaning requirements.
- M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
 - 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Site Enclosure Fence: Before construction operations, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates. Adjust, add, and subtract fencing as necessary over the course of construction period, with no additional cost to owner.
- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 2. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
- G. See allowances section for amount to be included in the contract sum for site security.

3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01 5000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 012500 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

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

- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
 - 1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 - 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."
- F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

1.3 QUALITY ASSURANCE

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

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

1.5 PRODUCT WARRANTIES

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

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

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

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

3. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
4. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.
- C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
- E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.
 1. Select products for which sustainable design documentation submittals are available from manufacturer.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
 - 2. Section 044313.13 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
 - 3. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

- A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.
- C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner's property.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.4 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

1.5 QUALITY ASSURANCE

- A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements.
- B. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
 - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS – Not Used

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
 - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 4. Store components off the ground and protect from the weather.
 - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.3 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

D. Paint: Seal containers and store by type.

3.4 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017600 – GUARANTIES AND WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for guaranties and warranties for contract closeout and during specified guaranty/warranty periods.

1.2 DESCRIPTION OF REQUIREMENTS

- A. General Limitations: It is recognized that specific guaranties and warranties are intended to protect Owner against failure of the Work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.
- B. Related Damages and Losses: When correcting guarantied or warranted work which has failed, remove and replace other Work of Project which has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of Work.
- C. Reinstatement of Guaranty or Warranty Period: In addition to requirements in the General Conditions, when Work covered by a special project guaranty or product warranty has failed and has been corrected by replacement or restoration, reinstate guaranty or warranty by written endorsement for 1 year starting on date of acceptance of replaced or restored Work.
- D. Replacement Cost, Obligations: Except as otherwise indicated, cost of replacing or restoring failing guaranties or warranted units or products is Contractor's obligation, without regard for whether Owner has already benefitted from use through a portion of anticipated useful service lives.
- E. Rejection of Warranties: Owner reserves the right, at time of Substantial Completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner detract from or confuse interpretation of requirements of Contract Documents.
- F. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or subcontract for materials or units of Work for Project where a special project guaranty, specified product warranty, certification, or similar commitment is required until it has been determined that entities required to sign or countersign such commitments are willing to do so.
- G. Specific Guaranty or Warranty Forms: Where a special project guaranty or specified project warranty is required, prepare a written document to contain terms and appropriate identification; ready for execution by required parties.
 - 1. A sample form is attached as the last article of this Section.
 - 2. Refer to individual sections of Divisions 2 through 33 for specific content and requirements.
 - 3. Submit draft to Owner for approval prior to final executions.

1.3 REQUIREMENTS INCLUDED

- A. Compile specified warranties.
- B. Compile specified service and maintenance contracts.
- C. Co-execute submittals when so specified.
- D. Review submittals to verify compliance with Contract Documents.
- E. Submit to Architect for review and transmittal to Owner.

1.4 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: 2 each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete index information for each item.
 - 1. Product or work item with index number to bound item.
 - 2. Firm, with name of principal, address, and telephone number.
 - 3. Scope.
 - 4. Date of beginning of warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond, or service maintenance contract.
 - 6. Provide information for Owner's personnel:
 - a. Procedure to be followed in case of failure.
 - b. Circumstances which might affect the validity of warranty or bond.
 - 7. Contractor, name of responsible principal, address and telephone number.

1.5 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
 - 1. Size 8-1/2 x 11 inches on punched sheets for standard 3-ring binder.
 - a. Fold larger sheets to fit into binders.
 - 2. Warranty-Guaranty wording shall be as printed below.
 - 3. Cover: Identify each packet with typed or printed title "GUARANTIES AND WARRANTIES". List:

a. Title of Project.

b. Name of Contractor.

C. Binders: Commercial quality, 3-ring, with durable and cleanable plastic covers.

1.6 TIME OF SUBMITTALS

A. Make submittals within 10 days after date of Substantial Completion prior to final request for payment.

B. For items or work, where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

1.7 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective Sections of Specifications and as follows:

1. Provide when noted in individual Sections of the Project Manual Divisions 2 through 33.

1.8 SAMPLE FORM OF WARRANTY-GUARANTY

A. Print or type Warranty-Guaranty on installing contractor's own letterhead.

B. Wording and signatures required.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

A. GUARANTEE-WARRANTY

When required by the specifications, warranties and/or guarantees other than one year shall be in the form of the following on the Contractor's own letterhead:

"GUARANTEE-WARRANTY FOR INTERMOUNTAIN HEALTHCARE, Intermountain Kidney Services - Provo Dialysis project.

We hereby warrant and the General Contractor and/or Material Manufacturer guarantee that the (name of product, equipment or system) that we have installed in the 'Intermountain Kidney Services - Provo Dialysis' project, has been done in accordance with the Contract Documents and that the work as installed will fulfill the requirements of the guaranty-warranty included in the specifications. We agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or material within a period of _____ years from the date of Substantial Completion, without any expense whatsoever to the Owner, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above mentioned conditions within sixty (60) days after being notified in writing by the Owner, we collectively or separately do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand.

Signed _____
(Subcontractor)

Name _____
(Print)

Company _____

Address _____

Countersigned _____
(General Contractor)

Name _____
(Print)

Company _____

Address _____

License No. _____ License No. _____

Countersigned _____
(Material Manufacturer)

Name _____

Company _____

Address _____

SECTION 01 7700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

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

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance materials specified in individual Sections, including tools, spare parts, extra materials (attic stock), and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number.

- a. Schedule of Maintenance Material Items: Prepare and submit a list of extra materials (attic stock) and maintenance materials (spare parts, cleaners, etc.) to Owner and Architect. This list shall include the name and quantity of each item that has been stored by the contractor.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 - D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
 1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.
- 1.5 FINAL COMPLETION PROCEDURES
- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
 1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.

4. Submit final completion photographic documentation.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated file.
 - b. Web-based project software upload (if applicable). Utilize software feature for creating and updating list of incomplete items (punch list).

1.7 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
- D. Warranty Electronic Files: "Manuals Access" format.
 1. Provide files in PDF format as part of the "Manuals Access" program. Warranties section shall be divided by specification division.
 2. Submit along with Operation and Maintenance data. Refer to section 017823.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

- m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
- p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
- q. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE 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. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. 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.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
- B. Initial Manual Submittal: Submit draft copy of each manual at least 30 days prior to requesting inspection for Substantial Completion, or as necessary for review process and manual revision as necessary. Architect will comment on whether general scope and content of manual are acceptable.
 - 1. Correct or revise each manual to comply with Architect's comments.
- C. Final Manual Submittal: Submit each manual in final form prior to substantial completion.

1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Electronic Files: "Manuals Access" program format.

1. Provide files in PDF format as part of a Building Information Access file by "Manuals Access". Operation and Maintenance data shall be divided by specification division, along with warranties.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
3. Number of copies: Submit (3) thumb drives with final information to owner, once architect has reviewed and approved the manual content.

1.6 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for Construction Manager.
 7. Name and contact information for Architect.
 8. Name and contact information for Commissioning Authority.
 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 10. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include

information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.
- J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

1.11 PRODUCT MAINTENANCE MANUALS

- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Product Information: Include the following, as applicable:
1. Product name and model number.
 2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.

- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Miscellaneous record submittals.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings and Specifications: Comply with the following:
 - 1. Initial Submission to Architect: Turn over marked up paper plans and specifications to architect. Architect shall incorporate items into project drawings and specifications, creating the "Final Record Drawings and Specifications".
 - 2. Final Submission to Owner: Provide Final Record Drawings and Specifications from architect, as well as Record Submittals, in PDF format as part of the "Manuals Access" program. Submit along with Operation and Maintenance data. Refer to section 017823.
- B. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit final submittals as part of the "Manuals Access" program as stated above.

1.4 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.

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

1.5 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
- 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
- B. Format: Submit record Specifications as paper copy or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.6 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Format: Submit miscellaneous record submittals as paper copy or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.7 MAINTENANCE OF RECORD DOCUMENTS

- A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7839

SECTION 017900 - CLEANING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Requirements for periodic, general, and final cleaning of the project.
- B. Provide temporary and periodic clean-up of extra materials, waste and general debris during construction of the work, together with the final clean-up and cleaning, polishing and other "housekeeping" required to bring various surfaces to an acceptable condition prior to final inspection, or before additional work is done during construction.
- C. This Section includes requirements for Cleaning for all phases of the Project. Some requirements of this Section may not be applicable to individual project Phases.

1.2 GENERAL REQUIREMENTS

- A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish in accordance with applicable safety and insurance standards and local ordinances.
- B. The acceptable level of cleanliness of the Project shall be the decision of the Architect.
 - 1. Work necessary to achieve such acceptable state shall be performed when required.
- C. Burning: Burning of waste materials and/or rubbish on Site is not permitted.

1.3 CLEAN-UP DURING CONSTRUCTION

- A. During construction, provide cleaning-up as follows:
 - 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
 - 2. Remove debris and rubbish from pipe chases, plenums, down spouts, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
 - 3. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
 - 4. Remove waste materials, debris, and rubbish from site weekly, or more often if needed, and dispose off-site in compliance with local regulations.
 - 5. Storage areas: Ensure that materials to be used for construction are stored in designated structures or areas by the appropriate trades.

Maintain such areas or structures in a clean condition for the life of the Project.

6. Containers: Provide appropriate containers, such as dump containers, and locate on site for collection of waste materials and rubbish.
7. Supervision: Oversee all cleaning of areas by the trades using them. Ensure that resulting accumulations are deposited in appropriate containers.
8. Clean-up: Daily, weekly, or as necessary, clean-up floors and Site areas. Remove all loose materials, by sweeping if necessary.

1.4 FINAL CLEANING

- A. Provide final clean-up and polishing just prior to final inspection and/or acceptance of the work of the Project.
- B. Preparation:
 1. Prior to final inspection, remove all loose material of any nature, except spare parts, loose furniture or furnishings, manuals, parts books, and similar items.
 2. Remove all temporary buildings, utility lines or pipes and other work of a temporary nature.
 3. Remove all temporary wrappings. Leave no trace of wrap or adhesive.
- C. Surface Cleaning:
 1. Special cleaning for specific units of Work as specified and as shown on Drawings.
 2. Provide final cleaning of the Work, at time indicated, consisting of cleaning each surface or unit of Work to normal "clean" condition expected for a first-class building cleaning and maintenance program.
 3. Comply with manufacturer's instructions for cleaning operations.
- D. The following are examples, but not by way of limitation, of cleaning levels required:
 1. Remove labels which are not required as permanent labels.
 2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.
 3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of dust, stains, films, and similar noticeable distracting substances.

- a. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces.
 - b. Restore reflective surfaces to original reflective condition.
4. Wipe surfaces of mechanical and electrical equipment clean, including elevator equipment and similar equipment; remove excess lubrication and other substances.
5. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
6. Clean concrete floors in unoccupied spaces broom clean.
7. Vacuum clean carpeted surfaces and similar soft surfaces.
8. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
9. Clean light fixtures and lamps so as to function with full efficiency.
10. Clean Project Site (staging areas, Contractor Parking areas), including landscape development areas, of litter and foreign substances.
11. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills, and other foreign deposits.
- E. Pest Control: Engage an experienced exterminator to make a final inspection of Project, and to rid Project of rodents, insects, and other pests.
- F. Removal of Protection: Except as otherwise indicated or requested by Hospital Representative, remove temporary protection devices and facilities which were installed during course of Work to protect previously completed Work during remainder of construction period.
- G. Compliances:
 1. Comply with safety standards and governing regulations for cleaning operations.
 2. Do not burn waste materials at site, or bury debris or excess materials on the property, or discharge volatile or other harmful or dangerous materials into drainage systems.
 3. Remove waste materials from site and dispose of in a lawful manner.
- H. Moving Parts: Lubricate moving parts as recommended by the parts manufacturer, or as directed by the Architect. Wipe clean, all surplus lubricants.
- I. Protection: Protect finished floors from damage due to traffic or other causes.

END OF SECTION

SECTION 03 2000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel reinforcement bars.
 - 2. Welded-wire reinforcement.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of steel reinforcement.
 - 2. Epoxy repair coating.
 - 3. Zinc repair material.
 - 4. Bar supports.
 - 5. Mechanical splice couplers.
 - 6. Structural thermal break insulated connection system.
- B. Shop Drawings: Comply with ACI SP-066:
 - 1. Include placing drawings that detail fabrication, bending, and placement.
 - 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
- C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A615/A615M, **Grade 60**, deformed.

2.2 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.
 1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protection of In-Place Conditions:
 1. Do not cut or puncture vapor retarder.
 2. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

- A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.
- B. Accurately position, support, and secure reinforcement against displacement.
 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 2. Do not tack weld crossing reinforcing bars.

- C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- D. Provide concrete coverage in accordance with ACI 318.
- E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- F. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

3.3 JOINTS

- A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
- B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

- A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
 - 1. Steel-reinforcement placement.

END OF SECTION 03 2000

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

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 specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Concrete over metal deck

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Install joints as shown on drawings.
 - 1. Concealed concrete: Plywood, metal or other approved panel materials.
 - 2. Concrete exposed to view: HDO faced plywood US product standard AC or BB class. Material must be new or in like-new condition. No damaged material may be used at exposed concrete locations.
 - 3. Provide sack-rubbed finish on all exterior foundation walls exposed to view and other locations as indicated. Provide mockup of finish for review by architect.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum. Provide strips in profiles to provide reveals as shown on the drawings.
- C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
 - 2. Concrete exposed to view: Use 100% chemical type form release agents. No petroleum based agents are allowed.
- D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spilling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
 - 2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
 - 3. Exposed Concrete Foundation Walls: Furnish cone ties with a 1 1/2" break-back and neoprene washer for water seal.
 - 4. Arrange ties in a neat, orderly, symmetrical pattern, where tie holes are called to be visible. Submit cone tie pattern to architect for approval prior to installation of formwork.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.3 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch.
 - a. Match color and texture of exposed aggregate on adjacent, existing building.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

2.6 FLOOR AND SLAB TREATMENTS

- A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
 - 1. Products:
 - a. Burke by Edoco; Titan Hard.
 - b. ChemMasters; Chemisil Plus.
 - c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Intraseal.
 - d. Curecrete Distribution Inc.; Ashford Formula.
 - e. Dayton Superior Corporation; Day-Chem Sure Hard.
 - f. Euclid Chemical Company (The); Euco Diamond Hard.
 - g. L&M Construction Chemicals, Inc.; Seal Hard.
 - h. Meadows, W. R., Inc.; Liqui-Hard.
 - i. Vexcon Chemicals, Inc.; Vexcon StarSeal PS.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
 - 1. Products:
 - a. Burke by Edoco; BurkeFilm.
 - b. ChemMasters; Spray-Film.
 - c. Euclid Chemical Company (The); Eucobar.
 - d. Meadows, W. R., Inc.; Sealtight Evapre.
 - e. Metalcrete Industries; Waterhold.
 - f. Sika Corporation, Inc.; SikaFilm.
 - g. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
 - 1. Products:
 - a. Burke by Edoco; Aqua Resin Cure.
 - b. ChemMasters; Safe-Cure Clear.
 - c. Euclid Chemical Company (The); Kurez DR VOX.
 - d. Meadows, W. R., Inc.; 1100 Clear.
 - e. US Mix Products Company; US Spec Maxcure Resin Clear.
 - f. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.
 - g. Sonneborne Form Saver
 - h. Nox Crete

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- D. Reglets: Fabricate reglets of not less than 0.0217-inch-thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- E. Non-shrink grout: ASTM C1107 Grade B, non-metallic, factory pre-mixed grout. Products include:
 - 1. Masterflow 713, Master Builders
 - 2. SonogROUT, Sonneborn-Contech
 - 3. Euco-NS, Euclid Chemical Co.
 - 4. Crystex, L&M Cons. Chemical Co.
 - 5. Sure-Grip Grout, Dayton Superior Corp.
 - 6. Horngrout, A.C. Horn
 - 7. Supreme Grout, Gifford-Hill & Co., Inc.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5700 psi at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
 - 1. Fly Ash: 20 percent.
 - 2. Combined Fly Ash and Pozzolan: 15 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Proportion normal-weight concrete mixture as follows:
 - 1. Minimum Compressive Strength: See structural drawings.
 - 2. Maximum Water-Cementitious Materials Ratio: See requirements in structural drawings and coordinate with ACI 318-14.

3. Air Content: See requirements in structural drawings and coordinate with ACI 318-14 for 3/4-inch nominal maximum aggregate size.
- B. Foundation Walls: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See structural drawings.
 2. Maximum Water-Cementitious Materials Ratio: See requirements in structural drawings and coordinate with ACI 318-14.
 3. Air Content: See requirements in structural drawings and coordinate with ACI 318-14 for 3/4-inch nominal maximum aggregate size.
- C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See structural drawings.
 2. Maximum Water-Cementitious Materials Ratio: See requirements in structural drawings and coordinate with ACI 318-14.
 3. Air Content: 2 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
- D. Concrete Over Metal Deck: Proportion normal-weight concrete mixture as follows:
 1. Minimum Compressive Strength: See structural drawings.
 2. Maximum Water-Cementitious Materials Ratio: See requirements in structural drawings and coordinate with ACI 318-14.
 3. Air Content: 2 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class C, 1/2 inch for rough-formed finished surfaces.
 2. Class B, 1/4 inch for rough-formed finished surfaces (for retaining walls exposed to view greater than 18 inches).
 3. Class A, 1/8 inch for smooth-formed finished surfaces (for retaining walls exposed to view).

4. Exposed concrete foundation walls: HDO faced plywood US product standard AC or BB Class. Material must be new or in like-new condition.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Exposed concrete foundation walls: Arrange forms orderly and symmetrically with a minimum of seams.
- F. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement. Use 100% chemical type form release agent at exposed foundation walls.
- M. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and attach securely to prevent deflection and maintain stability of liners during concreting. Prevent form liners from sagging and stretching in hot weather. Seal joints of form liners and form liner accessories to prevent mortar leaks. Coat form liner with form-release agent.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 - 3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting

action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
 - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 7 Section "Joint Sealants," are indicated.
 - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- C. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- D. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- E. Hot-Weather Placement: Comply with ACI 301 and as follows:
 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
- B. Sack-Rubbed Finish at walls exposed to view:
 1. Remove any remaining cone ties.
 2. Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive material until producing a uniform color and texture. No form tie holes, form joints, air holes, or other defects shall be visible
 3. After concrete has cured for a minimum of twenty-eight (28) days, Coordinate on-site concrete inspection of installed work.
 4. Seal concrete with graffiti protection listed in other specifications sections.

3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.
 1. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
 - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
- D. Broom Finish: Apply a non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded. Curbs are to slope away from adjacent vertical surfaces unless otherwise indicated to be level.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.

- c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project..
3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.11 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.12 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 1. Concealed concrete: Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried.
 2. Smooth formed exposed concrete foundation walls: No plastering will be allowed at exposed to view concrete surfaces. Repair and patch defective areas only as approved by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.13 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
1. Steel reinforcement placement.
 2. Verification of concrete strength before removal of shores and forms from slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 03 3000

SECTION 048100 - UNIT MASONRY ASSEMBLIES

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. The Masonry Contractor shall provide documents verifying his ability to bond or shall provide a bid bond in the amount of 5% of the bid price.
- B. This Section includes unit masonry assemblies consisting of the following:
 - 1. Brick veneer (face brick)
 - 2. Mortar and grout.
 - 3. Reinforcing steel.
 - 4. Masonry joint reinforcement.
 - 5. Ties and Anchors.
 - 6. Embedded flashing
 - 7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

1.4 PERFORMANCE REQUIREMENTS

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For all colors, textures, shapes and sizes furnish the following:
 - 1. Concrete masonry units, in the form of small-scale units.
 - 2. Face brick, in the form of straps of five or more bricks.
 - 3. Colored mortar.
 - 4. Weep holes/vents.
- C. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:
 - 1. Brick Veneer.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
 - 1. Include test reports, per ASTM C 780, for mortar mixes required to comply with proportion specification.
 - 2. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather requirements.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1093 for testing indicated, as documented according to ASTM E 548.
- B. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.
- C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.
- D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical wall areas as required to demonstrate full range of materials, colors, shapes and sizes including headers, lintels, corners, sills and wall ends that are to be incorporated into the Work, 16 Square Feet minimum.
 - 2. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
- B. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

- C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
- D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the manufacturers specified in the drawings, or by local manufacturer capable of complying with project requirements.

2.2 MASONRY UNITS, GENERAL

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

2.3 BRICK

- A. General: Provide shapes indicated and as follows:
 - 1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
 - 2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners and as indicated on the drawings.
 - 3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Face Brick: ASTM C 216 Grade SW, Type FBX.
 - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
 - 2. Initial Rate of Absorption: Less than 30 g/30 sq. in per minute when tested per ASTM C 67.
 - 3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
 - 4. Size (Actual Dimensions): Standard brick manufactured by Interstate Brick Company, 3-9/16 inches wide by 3-9/16 inches high by 7-9/16 inches long, and other sizes as indicated on the drawings.
 - 5. Application: Use where brick is exposed, unless otherwise indicated.
 - 6. Color and Texture: Brick shall be manufactured with colors and textures and special shapes as indicated on the drawings.

2.4 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

- B. Hydrated Lime: ASTM C 207, Type S.
- C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortar.
 - 1. Products:
 - a. Bayer Corporation, Industrial Chemicals Div.; Bayferrox Iron Oxide Pigments.
 - b. Davis Colors; True Tone Mortar Colors.
 - c. Solomon Grind-Chem Services, Inc.; SGS Mortar Colors.
- D. Colored Cement Product: Packaged blend made from portland cement and lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
 - 1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
 - 2. Pigments shall not exceed 10 percent of portland cement by weight.
 - 3. Products:
 - a. Colored Portland Cement-Lime Mix:
 - 1) Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
 - 2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
 - 3) Lafarge North America Inc.; Eaglebond.
 - 4) Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
- E. Aggregate for Mortar: ASTM C 144.
 - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
 - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- F. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
 - 1. Products:
 - a. Euclid Chemical Company (The); Accelguard 80.
 - b. Grace Construction Products, a unit of W. R. Grace & Co. - Conn.; Morset.
 - c. Sonneborn, Div. of ChemRex; Trimix-NCA.
- G. Water: Potable.

2.5 REINFORCEMENT

- A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M, Grade 60.
- B. Masonry Joint Reinforcement, General: ASTM A 951.
 - 1. Interior Walls: Mill or Hot-dip galvanized, carbon steel.
 - 2. Exterior Walls: Hot-dip galvanized, carbon steel.
 - 3. Wire Size for Side Rods: 0.148-inch (#9 wire) diameter.
 - 4. Wire Size for Cross Rods: 0.148-inch (#9 wire) diameter.
 - 5. Spacing of Cross Rods, and Tabs: Not more than 16 inches o.c.
 - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

- D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors:
 - 1. Three (3) #9 wire at veneer, hot-dip galvanized carbon steel continuous wire.

2.6 TIES AND ANCHORS

- A. Materials:
 - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
- B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch made from steel sheet, galvanized after fabrication not less than 0.043 inch thick. Ties made from galvanized steel sheet may be used in interior walls, unless otherwise indicated.

2.7 EMBEDDED FLASHING

- A. Flexible Flashing: Use the following unless otherwise indicated:
 - 1. Self-Adhering, Stainless Steel Through-Wall Flashing: Composite, flashing product consisting of 2 mil of Type 304 stainless steel sheet, bonded to a layer of polymeric fabric with a butyl adhesive to produce an overall thickness of 10 mil. Use this type of flashing behind masonry veneers.
 - 2. Rubberized-Asphalt Flashing: Use this type of flashing around window and door openings. See section 072500 for more information.
- B. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
 - 1. Fabricate through-wall flashing with drip edge. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed. See section 076200 for metal drip edge.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

- A. Weep/Vent Products: Use one of the following, unless otherwise indicated:
 - 1. Round Plastic Weep/Vent Tube with extended wick: Clear butyrate, 3/8 by 1-1/2 by 3-1/2 inches long, or as necessary due to field conditions.

2.9 MASONRY-CELL INSULATION

- A. Inject empty cells with expandable type liquid insulation at all exterior walls.

2.10 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
 - 1. Manufacturers:
 - a. Diedrich Technologies, Inc.
 - b. EaCo Chem, Inc.
 - c. ProSoCo, Inc.

2.11 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 - 1. Do not use calcium chloride in mortar or grout.
 - 2. Limit cementitious materials in mortar to portland cement and lime.
 - 3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Mortar for Unit Masonry: Comply with ASTM C 270 and BIA Technical Notes 8A, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
 - 1. For all masonry, use Type S 2000 psi compressive strength.
 - 2. At exterior masonry walls use Dry-block by Grace Construction products (or architect's approved equal) integral water-repellant admixture in dosage requirements per the manufacturer's written recommendations.
- C. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required.
 - 1. Pigments shall not exceed 10 percent of portland cement by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
 - 1. Verify that foundations are within tolerances specified.
 - 2. Verify that reinforcing dowels are properly placed.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.
2. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
4. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch. Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
5. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

3.3 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond pattern. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.4 MORTAR BEDDING AND JOINTING

- A. Lay concrete masonry units as follows:
 1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
 2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
 3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
 4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.
- B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.
 1. For exposed masonry units, use a nonmetallic jointer 3/4 inch or more in width.
 2. For brick veneer, use quarter bond, concaved tooled and raked joint as indicated on drawings.

3.5 MASONRY JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
 1. Space reinforcement not more than 16 inches o.c.
- B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.

3.6 ANCHORING MASONRY VENEERS

- A. Anchor masonry veneers to concrete and masonry backup with seismic masonry-veneer anchors to comply with the following requirements:
 - 1. Fasten screw-attached and seismic anchors to concrete and masonry backup with metal fasteners of type indicated.
 - 2. Space anchors as indicated, but not more than 16 inches o.c. vertically and 32 inches o.c. horizontally with not less than 1 anchor for each 3.5 sq. ft. of wall area or as indicated on the drawings. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

3.7 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

3.8 LINTELS

- A. Install steel lintels where indicated.
- B. Provide minimum bearing of 8 inches at each jamb, unless otherwise indicated.

3.9 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded copper flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
 - 1. Use specified weep/vent products to form weep holes.
 - 2. Space weep holes formed from plastic tubing 16 inches o.c.
- C. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.10 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
 - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.11 MASONRY WASTE DISPOSAL

- A. Excess Masonry Waste: Remove excess masonry waste and legally dispose of off Owner's property.

END OF SECTION 048100

SECTION 050500 – METAL FASTENERS

Part 1 - GENERAL

1.1 SUMMARY

- A. Work Included: This Section establishes general standards and requirements for metal fasteners utilized for attachment of items to the primary structure of the building and is incorporated in others Sections of these specifications where referenced, including:
 - 1. Expansion Bolts.
 - 2. Bolts, screws and other fasteners.
- B. Work Specified Elsewhere:
 - 1. Division 5 – Miscellaneous Metal Fabrications.
 - 2. Division 23 – Mechanical.
 - 3. Division 26 – Electrical.

1.2 SUBMITTALS

- A. Comply with provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturers' information on materials, fabrication, and installation. Include current ICC or IAPMO Reports and other information to substantiate compliance with Contract Documents.
- C. Substitutions: Include with requests for substitution of fastening device type, minimum embedment, length, load capacity for pull out and shear, and installation torque of fasteners and statement that fastening devices meet or exceed requirements specified in Contract Documents.

Part 2 - PRODUCTS

2.1 MATERIALS

- A. Expansion Bolts: Hilti, Inc.'s Kwik Bolt TZ2, E.O.R. approved equivalent or as indicated. Provide stainless steel expansion bolts for exterior exposure.
- B. Sheet Metal Screws: John Wagner Associates' Grabber or equal: Unless otherwise noted on Drawings, type to suit stud, track, or channel gauge and as follows.
 - 1. Where Overlaid with Gypsum Board or Other Finish Material:
 - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Wafer Head Streaker.
 - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Wafer Head Self-Drilling.
 - 2. Where Not Overlaid with Finish Material:
 - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Hex Head Streaker.
 - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Hex Head Self-Drilling.
- C. Nuts and Bolts: ASTM A307 with suitable nuts, in accordance with ASTM A563, and washers 1/4-inch diameter, unless otherwise noted.
- D. U-Bolts: Special sizes and shapes shown; material as specified for nuts and bolts.

Part 3 - EXECUTION

3.1 INSTALLATION

- A. Expansion Bolts: Install in predrilled holes for fastening items into concrete.
 - 1. Install expansion bolts according to the manufacturer's instructions as to tools, torque and tightening procedure.
 - 2. Expansion bolt locations and spacings: As shown.
 - 3. Edge Distance: Not less than 10 bolt diameters.
 - 4. Unless otherwise noted, install expansion bolts with manufacturer's recommended minimum embedments. Embedment length is exclusive of thickness of floor coverings, grout pads or other overlays.
 - 5. Do not recess expansion bolts more than one-fourth of the nominal bolt diameter. Abandon overdrilled holes or partially fill with nonshrink grout and redrill when grout has set.
 - 6. Abandon holes if the axis of a drilled hole deviates more than 5 degrees from normal to the concrete surface.
 - 7. If a concrete reinforcing bar is encountered during drilling, immediately terminate drilling and notify the Architect. Subject to review and approval the SEOR, the Architect may authorize using one of the following procedures:
 - a. If the location may be shifted, fill abandoned hole with nonshrink grout and install expansion bolt with a minimum of 1/2 inch of sound concrete between the expansion bolt and the abandoned hole, or...
 - b. If the location may not be shifted, use a diamond core drill to cut the rebar and drill the hole beyond the reinforcing such that the whole wedge portion of the expansion bolt can be expanded below the bar, or...
 - c. If the location may not be shifted, core an oversize hole at the direction of the Architect and grout an acceptable anchor in place.
- B. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.
- C. When expansion bolts are installed through metal deck into concrete slab above, embedment shall not extend closer than 3/4-inch to top of concrete. Locate at center of bottom flute. Minimum embedment shall be 1-1/2-inches above top flute of decking.

END OF SECTION

SECTION 05 1200 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Structural steel.
 - 2. Grout.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication of structural-steel components.
 - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 - 2. Include embedment drawings.
 - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
 - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
- C. Welding certificates.
- D. Qualification Data: For fabricator.

1.5 QUALITY ASSURANCE

- A. Fabricator & Erector Qualifications: The fabricator and erector shall maintain a quality control program to ensure that the work is performed in accordance with the requirements in the AISC 303-10, the AISC Specification and the contract documents. The fabricator and erector shall have the option to use the AISC Quality Certification Program to establish and administer the quality control program. The Erector shall be capable of performing the erection of the Structural Steel, and shall provide the equipment, personnel and management for the scope, magnitude and required quality of this project.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."
- C. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
3. AISC's "Specification for the Design of Steel Hollow Structural Sections."
4. AISC's Specification for Allowable Stress Design of Single-Angle Members.
5. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
 1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
 2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

- A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M, Grade 50.
- B. Channels, Angles, M, S -Shapes: ASTM A 36/A 36M.
- C. Plate and Bar (Typical): ASTM A 36/A 36M.
- D. Base Plates: ASTM A 36/A 36M, unless noted otherwise.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B (46 ksi), structural tubing.
- F. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
 1. Weight Class: As indicated.
 2. Finish: Black, except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563 heavy hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.
- B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

- C. Headed Anchor Rods: ASTM A 307, Grade A, straight.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
 - 3. Washers: ASTM F 436 hardened carbon steel.
 - 4. Finish: Plain.

- D. Threaded Rods: ASTM A 307, Grade A.
 - 1. Nuts: ASTM A 563 hex carbon steel.
 - 2. Washers: ASTM F 436 carbon steel.
 - 3. Finish: Plain.

- E. Anchor Bolts (Typical Column): ASTM F 1554, Grade 36.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: Grade A.
 - 3. Finish: Plain.

- F. Anchor Bolts (Brace Frame or Moment Frame): ASTM F 1554, Grade per structural drawings.
 - 1. Nuts: ASTM A 563 heavy hex carbon steel.
 - 2. Washers: ASTM F436.
 - 3. Finish: Plain.

2.3 GROUT

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

2.4 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design.
 - 1. Mark and match-mark materials for field assembly.
 - 2. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

- B. Bolt Holes: Cut, drill or punch standard bolt holes perpendicular to metal surfaces.

- C. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

2.5 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's Specification for Structural Joints Using ASTM A 325 Bolts for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless noted otherwise.

- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

2.6 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field welded.
 - 3. Galvanized surfaces.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces. See special requirements for Surface Preparation and Priming at exposed exterior structural steel.
- D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
- E. Surface Preparation and Primer for High Performance Coatings: At Exterior Exposed Steel (And at All locations where High Performance Coatings – Exterior, are used), Grind all welds smooth and remove manufacturer's marks prior to priming. Provide the following:
 - 1. Shop Surface Preparation: SSPC-SP10/NACE 2 Near White Blast Cleaning with a minimum angular anchor profile of 1.5 mils
 - 2. Shop Applied Prime Coat: Tnemec, Tneme-Zinc Series 90-97 at 2.5 - 3.5 mils dft or Architect's approved equal that is compatible with the High Performance Coating at that location.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
 - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design".
- B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 - 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
 - 3. Promptly pack grout solidly between bearing surfaces and base[or bearing] plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened, unless noted otherwise.
- B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
 - 1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 - 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
- D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

- A. Repair damaged shop primed surfaces with repair paint.

END OF SECTION 05 1200

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Open-web K-series steel joists.
 - 2. Open-web LH-series steel joists.
 - 3. Open-web steel joist girders.
 - 4. Joist accessories.

1.3 DEFINITIONS

- A. Special Joists: Joists requiring modification by the manufacturer to support nonuniform, unequal, or special loading conditions that invalidate SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders."

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide special joists and connections capable of withstanding the design loads shown on drawings within limits and under conditions indicated.
- B. Design joists to withstand design loads with deflections no greater than the following:
 - 1. Roof Joists: Vertical deflection of 1/240 of the span for total load, and 1/360 for live load, and as indicated in the Structural Notes on the Drawings.

1.5 SUBMITTALS

- A. Product Data: For each type of joist, accessory, and product indicated.
- B. Shop Drawings: Show layout, mark, number, type, location, and spacings of joists. Include joining and anchorage details, bracing, bridging, accessories; splice and connection locations and details; and attachments to other construction.
 - 1. Indicate locations and details of anchorage devices and bearing plates to be embedded in other construction.
 - 2. Comprehensive engineering analysis signed and sealed by the qualified professional engineer responsible for its preparation.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Mill certificates signed by manufacturers of bolts certifying that their products comply with specified requirements.
- E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names

and addresses, names and addresses of architects and owners, and other information specified.

- F. Research/Evaluation Reports: Evidence of steel joists' compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance.
 - 1. Manufacturer must be certified by SJI to manufacture joists complying with SJI standard specifications and load tables.
 - 2. Assumes responsibility for engineering special joists to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 3. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of joists that are similar to those indicated for this Project in material, design, and extent.
- B. SJI Specifications: Comply with SJI's "Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders" (hereafter, "Specifications"), applicable to types of joists indicated.
- C. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel"; and AWS D1.3 "Structural Welding Code--Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle joists as recommended in SJI's "Specifications."
- B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

- A. Deliver steel bearing plates and other devices to be built into concrete and masonry construction.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel: Comply with SJI's "Specifications" for chord and web members.
- B. Steel Bearing Plates: ASTM A 36/A 36M.
- C. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A, carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.
 - 1. Finish: Plain, uncoated.
- D. High-Strength Bolts and Nuts: ASTM A 325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers.

1. Finish: Plain, uncoated.

E. Welding Electrodes: Comply with AWS standards.

F. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

2.2 PRIMERS

A. Primer: SSPC-Paint 15, Type I, red oxide; FS TT-P-636, red oxide; or manufacturer's standard shop primer complying with performance requirements of either of these red-oxide primers.

B. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements in FS TT-P-664.

2.3 OPEN-WEB K-SERIES AND LH-SERIES STEEL JOISTS

A. Manufacture steel joists according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord; of joist type indicated.

1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

2. Joist Type: LH-series steel joists.

B. Comply with AWS requirements and procedures for shop welding, appearance, quality of welds, and methods used in correcting welding work.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Camber joists according to SJI's "Specifications."

E. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.4 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span.

B. Bridging: Fabricate as indicated and according to SJI's "Specifications."

1. Furnish additional erection bridging if required.

C. Fabricate steel bearing plates with integral anchorages of sizes and thicknesses indicated. Shop prime paint.

D. Steel bearing plates with integral anchorages are specified in Division 5 Section "Metal Fabrications."

E. Supply miscellaneous accessories, including splice plates and bolts required by joist manufacturer to complete joist installation.

2.5 CLEANING AND SHOP PAINTING

- A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories to be primed by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.
- B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.
- C. Apply one shop coat of primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.
- D. Painting of joists and joist accessories is specified in Division 9 Section "Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates, embedded bearing plates, and abutting structural framing, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Do not install joists until supporting construction is in place and secured.
- B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.
 - 1. Before installation, splice joists delivered to Project site in more than one piece.
 - 2. Space, adjust, and align joists accurately in location before permanently fastening.
 - 3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
 - 4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads have been applied.
- C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
- D. Bolt joists to supporting steel framework using carbon-steel bolts, unless otherwise indicated.
- E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.
- F. Joists shall not be field modified in any way without the written consent of the manufacturer. All modifications shall be engineered and detailed by the manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.
- B. Field welds will be visually inspected according to AWS D1.1.

- C. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following procedures, as applicable:
 - 1. Radiographic Testing: ASTM E 94 and ASTM E 142.
 - 2. Magnetic Particle Inspection: ASTM E 709.
 - 3. Ultrasonic Testing: ASTM E 164.
 - 4. Liquid Penetrant Inspection: ASTM E 165.
- D. Bolted connections will be visually inspected.
 - 1. High-strength, field-bolted connections will be tested and verified according to procedures in RCSC's "Allowable Stress Design Specification for Structural Joints Using ASTM A 325 or ASTM A 490 Bolts."
- E. Correct deficiencies in Work that inspections and test reports have indicated are not in compliance with specified requirements.
- F. Additional testing will be performed to determine compliance of corrected Work with specified requirements.

3.4 REPAIRS AND PROTECTION

- A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates and abutting structural steel.
 - 1. Clean and prepare surfaces by hand-tool cleaning, SSPC-SP 2, or power-tool cleaning, SSPC-SP 3.
 - 2. Apply a compatible primer of the same type as the shop primer used on adjacent surfaces.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 Section "Painting."
- D. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 2100

SECTION 05 3100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite floor deck.

1.3 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- C. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Steel Deck:
 - a. BHP Steel Building Products USA Inc.
 - b. Consolidated Systems, Inc.
 - c. Epic Metals Corp.
 - d. Marlyn Steel Products, Inc.
 - e. Nucor Corp.; Vulcraft Div.
 - f. Roof Deck, Inc.
 - g. United Steel Deck, Inc.
 - h. Verco Manufacturing Co.
 - i. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp.

2.2 ROOF AND COMPOSITE FLOOR DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:
1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 zinc coating.
 2. Deck Profile: As indicated on structural drawings.
 3. Profile Depth: As indicated on structural drawings.
 4. Design Uncoated-Steel Thickness: As indicated on structural drawings.
 5. Span Condition: As indicated on structural drawings.
 6. Side Laps: Interlocking seam.
- B. Steel Composite Floor Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Composite Floor Deck," in SDI Publication No. 29, and the following:
1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33 zinc coating.
 2. Deck Profile: As indicated.
 3. Profile Depth: As indicated.
 4. Design Uncoated-Steel Thickness: As indicated.
 5. Span Condition: As indicated.
 6. Side Laps: Interlocking seam.

2.3 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Submit alternate per drawings if desired.
- C. Side-Lap Fasteners: Welded as per drawings.
- D. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

- E. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may not be used in lieu of welding to fasten deck without approval of the structural engineer.

3.3 ROOF AND COMPOSITE FLOOR DECK INSTALLATION

- A. Fasten panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches long, and as follows:
 - 1. Weld Diameter: As indicated on structural drawings.
 - 2. Weld Spacing: As indicated on structural drawings.
 - 3. Weld Washers: Install weld washers per manufacturer recommendations.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated.
 - 1. Fasten with a minimum of 1-1/2-inch-long welds at spacing indicated.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches.

- D. Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld at each corner.
- E. Miscellaneous Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.
- B. Field welds will be subject to inspection.
- C. Remove and replace work that does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION 05 3100

SECTION 05 4000 – COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior non-load-bearing wall framing.
 - 2. Gypsum sheathing and air infiltration barriers.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated in structural general notes.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
 - b. Exterior Non-Load-Bearing Framing:
 - 1) Horizontal deflection of 1/480 of the wall height for walls supporting brick veneer.
 - 2) Horizontal deflection of 1/360 of the wall height for walls supporting metal panel or EIFS system.
 - 3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward movement of 3/8" and downward movement of 1/360 of the span of the framing above.
- B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal out of plane deflection without regard for contribution of sheathing materials.

1.4 SUBMITTALS

- A. Product Data: For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:
 1. Steel sheet.
 2. Expansion anchors.
 3. Power-actuated anchors.
 4. Mechanical fasteners.
 5. Vertical deflection clips.
 6. Horizontal drift deflection clips
 7. Miscellaneous structural clips and accessories.
- E. Research/Evaluation Reports: For cold-formed metal framing.

1.5 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data sealed by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.

- E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."
- F. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
- G. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
 - 1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
 - 2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Allied Studco.
 - 2. AllSteel Products, Inc.
 - 3. California Expanded Metal Products Company.
 - 4. Clark Steel Framing.
 - 5. Consolidated Fabricators Corp.; Building Products Division.
 - 6. Craco Metals Manufacturing, LLC.
 - 7. Custom Stud, Inc.
 - 8. Dale/Incor.
 - 9. Design Shapes in Steel.
 - 10. Dietrich Metal Framing; a Worthington Industries Company.
 - 11. Formetal Co. Inc. (The).
 - 12. Innovative Steel Systems.
 - 13. MarinoWare; a division of Ware Industries.
 - 14. Quail Run Building Materials, Inc.
 - 15. SCAFCO Corporation.
 - 16. Southeastern Stud & Components, Inc.
 - 17. Steel Construction Systems.
 - 18. Steeler, Inc.

19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
 1. Grade: As required by structural performance.
 2. Coating: G40.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: As required by structural performance.
 2. Coating: G90.

2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 18 Gage.
 2. Flange Width: 1-5/8 inches minimum.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 18 Gage.
 2. Flange Width: 1-1/4 inches minimum.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, and as follows:
 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dietrich Metal Framing; a Worthington Industries Company.
 - b. MarinoWare, a division of Ware Industries.
 - c. SCAFCO Corporation
 - d. The Steel Network, Inc.
 2. Minimum Base-Metal Thickness: 18 Gage typical, 18 Gage at Exterior.
 3. Flange Width: 1 inch plus the design gap for 1-story structures and 1 inch plus twice the design gap for other applications.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure.

2.4 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
 2. Bracing, bridging, and solid blocking.
 3. Web stiffeners.
 4. Anchor clips.
 5. End clips.
 6. Foundation clips.
 7. Gusset plates.
 8. Stud kickers, knee braces, and girts.
 9. Joist hangers and end closures.
 10. Hole reinforcing plates.
 11. Backer plates.

2.5 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.6 GYPSUM SHEATHING

- A. Paper-Surfaced Gypsum Sheathing Board with Water-Resistant Core: ASTM C 79, with water-resistant material incorporated into core and with water-repellent paper bonded to core's face, back, and long edges.
1. Type and Thickness: Type X, 5/8 inch thick.
 2. Edge and End Configuration: Square.
 3. Size: Manufacturer's standard.
 4. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Georgia-Pacific Corp.
 - b. National Gypsum Co.; Gold Bond Building Products Division.
 - c. USG Corp.; United States Gypsum Co.

2.7 SHEATHING ACCESSORIES

- A. Air-Infiltration Barrier: To be used at locations where spray-applied building insulation is not used. Use proprietary building wrap with flame-spread and smoke-developed ratings of less than 25 and 450, respectively, when tested according to ASTM E 84.
1. Polyethylene sheet; 0.0038 to 0.0064 inch thick; formed by spinning continuous strands of fine, high-density-polyethylene interconnected fibers and bonding them together by heat pressure; incorporated and additive to provide ultraviolet light resistance for up to 120 days; and with a water-vapor transmission rate equaling 535 g through 1 sq. m of surface in 24 hours according to ASTM E 96, Desiccant Method (Method A).
 - a. Product: Subject to compliance with requirements, provide "Tyvek Housewrap" by DuPont Company, or approved equal.
- B. Fasteners: Steel drill screws, ASTM C 954, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
- C. Elastomeric Sealant: Medium-modulus, neutral-curing silicone sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturers for application indicated, and complying with requirements for elastomeric sealants specified in Division 7 Section "Joint Sealants."

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035.

- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.9 FABRICATION

- A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
 - 4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

- b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation, specified in Division 7 Section "Building Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated on drawings or 16" o.c. minimum.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single-leg deflection tracks and anchor to building structure.
 - 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 - 3. Connect drift clips to cold formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of

width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

- a. Install solid blocking at 96-inch centers.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

3.5 GYPSUM SHEATHING INSTALLATION

- A. General: Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation: Install 48-inch-wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- G. Air-Infiltration Barrier Application: Cover sheathing with air-infiltration barrier as follows:
 - 1. Cut back air-infiltration barrier 1/2 inch on each side of break in supporting members at expansion-or control-joint locations.
 - 2. Apply proprietary building wrap to comply with manufacturer's written installation instructions.
- H. Sealing Sheathing Joints: Seal Joints according to sheathing manufacturer's written recommendations and as follows:

- I. Apply elastomeric sealant on joints and fasteners and trowel flat. Apply sufficient quantity of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

3.6 FIELD QUALITY CONTROL

- A. Field and shop welds will be subject to testing and inspecting.
- B. Remove and replace work that does not comply with specified requirements.
- C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.
- C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.
- D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

END OF SECTION 05 4000

SECTION 05 5000 - METAL 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:
 - 1. Loose bearing and leveling angles for masonry work.
 - 2. Loose steel lintels.
 - 3. Metal ladders.
 - 4. Metal bollards and other exterior pipe fabrications.
 - 5. Countertop supports.
 - 6. Steel supports for operable partitions and as indicated.
 - 7. Steel tube reinforcement for low partition walls.

1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
 - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
 - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- 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.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: ASME B18.6.3.
- E. Lag Bolts: ASME B18.2.1.
- F. Plain Washers: Round, ASME B18.22.1.
- G. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for reglazing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. 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 so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

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 retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.7 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. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls. Prepare exposed exterior lintels for high performance coatings as listed below.

2.8 METAL LADDERS

- A. General:
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
 - 2. Space siderails 18 inches apart, unless otherwise indicated.
 - 3. Support each ladder at top and bottom and not more than 60 inches with welded or bolted brackets, made from same metal as ladder.
- B. Steel Ladders:
 - 1. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
 - 2. Rungs: 3/4-inch-diameter steel bars.
 - 3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.

4. Galvanize exterior ladders, including brackets and fasteners.
5. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

- C. Galvanize steel ladders located on exterior of building.
- D. See Section 055100 "Metal Stairs" for pre-manufactured ship's ladders.

2.9 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Galvanize metal bollards.

2.10 UNISTRUT

- A. Provide unistrut as called for on the drawings for support of miscellaneous ceiling-anchored building elements.

2.11 STEEL AND IRON FINISHES

- A. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- B. Surface Preparation for High Performance Coatings: At exposed steel fabrications on the exterior of the building (and at all locations where High Performance Coatings – Exterior, are used), grind all welds smooth and remove manufacturer's marks prior to priming. Provide the following:
 1. Shop Surface Preparation: SSPC-SP10/NACE 2 Near White Blast Cleaning with a minimum angular anchor profile of 1.5 mils
 2. Shop Applied Prime Coat: Tnemec, Tnemec-Zinc Series 90-97 at 2.5 - 3.5 mils dft or Architect's approved equal that is compatible with the High Performance Coating at that location.

2.12 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.
 1. Fill vent holes and grind smooth after galvanizing.
 2. Galvanize lintels and shelf angles attached to structural and located in exterior walls.

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. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 INSTALLING PIPE BOLLARDS

- A. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- B. Fill bollards solidly with concrete, mounding top surface to shed water.

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.

END OF SECTION 0 55000

SECTION 05 5100 - METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Premanufactured aluminum ships ladders with aluminum treads and handrails.
 - 2. Preassembled steel stairs with concrete filled treads.

1.3 SUBMITTALS

- A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Include calculations for all railing components stamped by a registered professional engineer in the state of Utah complying with performance requirements of 2.1.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," for class of stair designated, unless more stringent requirements are indicated.

1.5 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.6 PREASSEMBLED STEEL STAIRS WITH CONCRETE FILLED TREADS

- A. Form pans for treads and risers in the configurations shown from steel sheet of thickness indicated.
- B. Fabricate stringers of steel tubes or channels, as shown in the drawings.
 - 1. Provide closures for exposed ends of steel tube stringers.
- C. Weld stringers to headers; weld steel pans to stringers.

1.7 FINISHES

- A. Provide clear, anodized finish on pre-manufactured aluminum ships ladders.

- B. Provide painted finish on exposed portions of steel stairs, including stringers and underside of stairs if exposed to view.

1.8 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes. Provide serrated treads.

1.9 FASTENERS

- A. Anchor Bolts: ASTM F 1554, Grade 36.
- B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1.10 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding, unless otherwise indicated.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

PART 2 - EXECUTION

2.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. 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.
- E. 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.

2.2 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas.

END OF SECTION 05 5100

SECTION 05 5213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Custom-made, interior and exterior stainless-steel pipe and tube railings.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Handrail brackets.
 - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Include calculations for all railing components stamped by a registered professional engineer in the state of Utah complying with performance requirements of 2.1.

1.5 INFORMATIONAL SUBMITTALS

- A. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

- C. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STAINLESS STEEL

- A. Tubing: ASTM A 554, Grade MT 304.
- B. Pipe: ASTM A312/A 312M, Grade TP 304. Use 1-1/4", Schedule 40, stainless steel (seamless) pipe (1.66" O.D.).
- C. Castings: ASTM A 743/A 743M, Grade CF 8 or CF 20
- D. Plate and Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Expanded Metal: ASTM F 1267, Type II (expanded and flattened)], Class 3 (corrosion-resistant steel), made from stainless-steel sheet, ASTM A 240/A 240M or ASTM A 666, Type 304.
 - 1. Style Designation: 3/4 number 13.

2.4 FASTENERS

- A. General: Provide the following:
 - 1. Stainless-Steel Railings: Type 304 stainless-steel fasteners.
 - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
 - 1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593 and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast stainless steel, center of handrail 2-1/2 inches from face of railing or wall.
- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For stainless-steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- C. 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.
- D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop-assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either welded or nonwelded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 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 flux immediately.
 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- J. Form Changes in Direction as Follows:
 1. As detailed.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For removable railing posts, fabricate slip-fit sockets from stainless-steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
 1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 STAINLESS-STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 1. Run grain with long dimension of each piece.
 2. When polishing is completed, passivate and rinse surfaces.
 3. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Stainless Steel Pipe and Tubing Finishes:
 1. 180-Grit Polished Finish: Uniform, directionally textured finish.
- D. Stainless Steel Sheet and Plate Finishes:
 1. Directional Satin Finish: ASTM A480/A480, No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
 - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
 - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.
- B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 6 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.
- C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
 - 2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
 - 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and connected to railing ends using nonwelded connections.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and connected to railing ends using nonwelded connections.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
 - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - 2. For hollow masonry anchorage, use toggle bolts.
 - 3. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
 - 4. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
 - 5. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 5213

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.

1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. WWPA - Western Wood Products Association.

1.4 SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- B. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee Board of Review.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Engineered Wood Products: Obtain each type of engineered wood product through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.
- B. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osmose Wood Preserving, Inc.

2.2 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of lumber grading agencies certified by the American Lumber Standards Committee Board of Review.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Provide dressed lumber, S4S, unless otherwise indicated.
 - 3. Provide dry lumber with 19 percent maximum moisture content at time of dressing for 2-inch nominal thickness or less, unless otherwise indicated.
- B. Wood Structural Panels:
 - 1. Plywood: Either DOC PS 1 or DOC PS 2, unless otherwise indicated.
 - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
 - 3. Comply with "Code Plus" provisions in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial."
 - 4. Factory mark panels according to indicated standard.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. General: Where wood-preservative-treated wood is indicated or required, comply with applicable requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Identify wood-preservative-treated wood with appropriate classification markings; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Exterior Type: Use for exterior locations and where indicated.

2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
 - 1. Rooftop equipment bases and support curbs.
 - 2. Blocking.
 - 3. Nailers.
 - 4. Furring.
- B. For items of dimension lumber size, provide No. 2 grade lumber with 19 percent maximum moisture content of the following species:

1. Douglas fir-larch; WWP.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Wood Screws: ASME B18.6.1.
- D. Lag Bolts: ASME B18.2.1.
- E. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Do not use materials with defects that impair quality of rough carpentry or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- C. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 1. CABO NER-272 for power-driven fasteners.
 2. Published requirements of metal framing anchor manufacturer.
 3. Table 2304.9.1 in the International Building Code.
- D. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
 1. Comply with "Code Plus" provisions in above-referenced guide.

END OF SECTION 06 1053

SECTION 06 1600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior Wall Sheathing.
 - 2. Fire Retardant Plywood.

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2.2 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated. Thickness: 5/8 inch thick.
 - 3. Size: 48 by 96 inches.
 - 4. Thickness: 1/2" or 3/4" as indicated on the drawings.

- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

2.3 EXTERIOR WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. G-P Gypsum Corporation; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond e(2)XP.
 - d. Temple-Inland Inc.; GreenGlass
 - e. United States Gypsum Co.; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches.
 - 4. Provide Building Wrap, or Architect's Approved Weather Barrier, over sheathing at areas not scheduled to receive spray-applied insulation.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
 - 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
 - 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
 - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."

- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 SHEATHING INSTALLATION

- A. Comply with with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

SECTION 06 4023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Plastic laminate-faced cabinets.
 - 2. Wood veneer-faced cabinets
 - 3. Solid-surfacing material countertops, wall caps, and sills, where indicated.
 - 4. Quartz stone countertops, wall caps, and sills, where indicated.
 - 5. Closet and utility shelving
 - 6. Continuous metal grilles to be installed as part of fin tube heating enclosure.

1.3 DEFINITIONS

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

1.4 SUBMITTALS

- A. Product Data: For cabinet hardware, provide cut sheet of each product for review.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- C. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 2. Wood Veneers, 8 by 10 inches, for each type, color, pattern, and surface finish.
 - 3. Solid-surfacing materials 6 inches square.
 - 4. One sample door with required hardware.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with applicable requirements of the "Architectural Woodwork Quality Standards" (AWS), 2nd Edition, for grades of interior architectural woodwork, construction, finishes, and other requirements.

- D. Millwork and installation shall be in accordance with **Premium Grade** of the Architectural Woodwork Standards (AWS), as indicated herein or on the Drawings. If provisions of the Grade specified are in conflict with, or modified by the Drawings or Specifications, the higher quality, better grade or greater quantity shall govern. Notify Architect of any conflicts prior to proceeding with fabrication.
- E. Prior to delivery to Project site, millwork supplier shall provide documentation to the Architect:
 - 1. If a Woodwork Institute (WI) licensee: a WI Certified Compliance Certificate with original submittals indicating the millwork products furnished for the project and certifying that these products and their installation will full meet all the requirements of the AWS grade(s) specified and the Contract Documents.
 - 2. If a non-WI licensee: a WI Certified Compliance Tracking Acknowledgement with the original submittals, that they have arranged for inspection by a WI inspector after completion of fabrication and installation. If all conditions are found to be compliant, the WI inspector will issue a Certified Compliance Certificate, indicating the millwork products furnished for this project, and certifying that these products and their installation fully meet the requirements of the AWS grades specified in the Contract Documents.
- F. Each casework elevation shall bear a WI Certified Compliance label.
- G. Each countertop shall bear a WI Certified Compliance label.
- H. Millwork contractor and installer shall include in their bid any and all costs for certified compliance. Under no circumstance shall the Owner incur additional expense due to the failure of the millwork to comply with AWS standards or to pass any inspection. Issuance of a Certified Compliance Certificate is a pre-requisite for final acceptance and final payment.
- I. Installer Qualifications: Arrange for installation of architectural woodwork by a firm which can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this project.
- J. Measurements: Before proceeding with fabrication of woodwork required to be fitted to other construction, obtain field measurements and verify dimensions and shop drawing details as required for accurate fit.
- K. Casework Integrity: All cabinets shall satisfy the AWS Appendix A testing standards:
 - 1. Structural Integrity Test (Base and wall cabinets)
 - 2. Concentrated Load Test (Base cabinet)
 - 3. Torsion Test (Base cabinet)
 - 4. Door Durability Test
 - 5. Door Impact Test
 - 6. Door Hinge Test
 - 7. Drawer Bottom Impact Test
 - 8. Drawer Support Test
 - 9. Drawer and Door Pull Test
 - 10. Drawer Rolling Load Test
 - 11. Shelf Load Test
- L. Testing: Owner reserves the right to take random sampling of casework components to verify that the materials and construction are as specified. In the event that one such sampling proves to be inferior to that which is specified, the entire installation shall become suspect of being inferior. Supplier shall, at his own expense, replace all components deemed inferior, or the supplier shall provide the quality of casework to the satisfaction of the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

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

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

- A. Source Limitations: Engage a qualified woodworking firm to assume responsibility for production of architectural cabinets with plastic laminates and wood veneers and tops as shown in the drawings.
- B. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Huetter Mill and Cabinet Company
 - 2. Granite Mill and Fixture Company
 - 3. Johnson Brothers

2.2 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 3. Hardwood Plywood and Face Veneers: HPVA HP-1.

- C. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates as indicated on the drawings - see Finish Schedule.
- E. Wood Veneer: Real wood veneer, Class A fire-rated, book-matched and sequence-matched.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the drawings – See Finish Schedule.
- F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the drawings – See Finish Schedule.
 - 2. Thickness: As indicated on Drawings or 1/2" if not indicated.
- G. Quartz Stone:
 - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on the drawings – See Finish Schedule
 - 2. Type: Standard Type, unless Special Purpose type is indicated.
 - 3. Colors and Patterns: Match Architect's samples.
 - 4. Thickness: As indicated on Drawings or 3/4" if not indicated.
- H. Adhesive for Bonding Plastic Laminate: Contact cement.
- I. Edge-banding:
 - 1. Edge-banding for cabinet body parts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment.
 - 2. Edge-banding for door and drawer fronts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with a 3 mm radius and scraped free from machining or chatter marks.
 - 3. Color shall be as selected by Architect from manufacturer's full color range.
- J. Cores:
 - 1. All sides, tops, bottoms, doors, drawer fronts, and partitions shall have minimum 3/4" thick thermoset decorative overlay, high-pressure decorative laminate, or wood veneer as listed above. Provide 1-inch thick multi-core premium grade panel product for bottom panel of wall hung units (same as shelves).
 - 2. Shelf Cores: 1-inch thick multi-core premium grade panel product
 - 3. Multi-Core Panel Products:
 - a. Plyon.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

- C. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- D. Wire Pulls: Back mounted, 5 inches long, 1 1/2 inches deep, and 5/16 inches in diameter.
- E. Inactive Leaf Latch: Ives Elbow Cabinet Catch # IVE-2A92, aluminum, spring loaded, surface mounted; 1-3/8 inch W x 1-3/8 inch H; with 5/8 inch x 3/4 inch H strike.
- F. Shelf Rests: BHMA A156.9, B04013.
- G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:
 - 1. Box Drawer Slides: 100 lbf.
 - 2. Pencil Drawer Slides: 45 lbf.
- H. Door Locks: Grade 1, pin tumbler lock, BHMA A156.11, E07121. Disc tumblers are not approved.
- I. Drawer Locks: Grade 1, pin tumbler lock, BHMA A156.11, E07041. Disc tumblers are not approved.
- J. Cable Grommets: Hafele, 429.94.310, zinc die-cast, black finish.
- K. Coat Hooks: Ives 572 F-15C.1 dull chrome.
- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Chromium Plated: BHMA 652 for steel base.
- M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.4 GRILLES FOR FIN TUBE CABINET ENCLOSURES

- A. Continuous, aluminum grille installed in window sill above fin tube radiant heating system.
 - 1. Basis-of-Design product: "B-Series, bi-directional grille, 6" wide, anodized aluminum, by Wenig Company (Wenigco Inc.).
 - 2. Provide basis-of-design product or comparable product by another manufacturer.

2.5 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.6 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide **Premium Grade** interior woodwork complying with the referenced quality standard.

- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

2.7 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Quality Standard: Comply with AWS (Architectural Woodwork Standards) Section 3.
- B. Grade: Premium.
- C. Wood Species and Cut: Walnut, plain sliced.

2.8 PLASTIC-LAMINATE CABINETS

- A. Quality Standard: Comply with AWS (Architectural Woodwork Standards) Section 10 (Casework)
- B. Grade: Premium.
- C. AWI Type of Cabinet Construction: Flush overlay.
- D. Laminate Cladding for Exposed Exterior and Exposed Interior Surfaces: High-pressure decorative laminate complying with the following requirements:
 - 1. Horizontal Surfaces Other Than Tops: HGS.
 - 2. Vertical Surfaces: VGS.
 - 3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
- E. Materials for Semiexposed Surfaces: Provide surface materials indicated below:
 - 1. Surfaces Other Than Drawer Bodies: Thermoset decorative overlay (Melamine).
 - 2. Drawer Sides and Backs: Solid hardwood lumber.
 - 3. Drawer Bottoms: Hardwood plywood.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes in the following categories:
 - a. Solid colors.
 - b. Patterns.

2.9 SOLID-SURFACING WALL CAPS, COUNTERTOPS & WINDOWSILLS

- A. Grade: Premium.
- B. Solid-Surfacing-Material Thickness:
 - 1. ½-inch or ¾-inch thick, depending on material, reference 2.2.F and 2.2.G. Provide shims and turned edges to follow overall thickness shown in drawings.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:

1. Match Architect's sample.
- D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
 1. Fabricate tops with shop-applied edges of materials and configuration indicated.

2.10 CLOSET AND UTILITY SHELIVING

- A. Materials: Use the following materials or products equivalent in performance and construction.
 1. Shelf Standards: Knape and Vogt K.V.85ANO 48 (4' long) and K.V.85ANO 84 (7' long).
 2. Shelf Brackets: Knape and Vogt K.V. 185ANO 12, K.V. 185ANO 16, K.V. 185ANO 18, and K.V. 185ANO 24 (at 12", 16", 18" and 24" shelving, respectively). See dimension plans for shelf depths to determine sizes to be used in this project.
 3. Shelves:
 - a. At Janitorial Closets, use $\frac{3}{4}$ " plywood, with plastic laminate on both sides and edge banded (light duty shelving applications).
 - b. At all other areas, including Storage Rooms, use 1" plywood with plastic laminate on both sides and edge banded (for books and heavy duty shelving applications).

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long, except where shorter single-length pieces are necessary.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.

2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 2. Secure backsplashes to tops and to walls.
 3. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
 4. Cut circular openings in countertop for electrical cord access below countertop. Provide a grommet around opening for finish appearance. Color of grommet to be selected. The number and exact location of openings will be determined in the field, but will generally be located where knee spaces and computer stations have been shown on the drawings.

3.3 ADJUSTING AND CLEANING

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

END OF SECTION 06 4023

SECTION 07 1353 - ELASTOMERIC SHEET WATERPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. EPDM rubber sheet waterproofing at exterior retaining walls adjacent to landscape areas (vertical walls).
 - 2. EPDM rubber sheet waterproofing at below grade building walls (vertical walls).
 - 3. Extruded polystyrene foam-plastic board insulation drainage panels

1.3 ACTION SUBMITTALS

- A. Samples: For each exposed product and for each color and texture specified, including the following products:
 - 1. 8-by-8-inch square of waterproofing and flashing sheet.
 - 2. 8-by-8-inch square of drainage panel.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
 - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Installer's Special Warranty: Form signed by Installer, covering Work of this Section, for warranty period of two years.

1. Warranty includes removing and reinstalling protection board and drainage panels.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials and protection course from single source from single manufacturer.

2.2 SHEET WATERPROOFING

- A. EPDM Rubber Sheet: ASTM D 6134, Type I, 60-mil-thick flexible sheet, unreinforced, formed from EPDM.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide the following product or a comparable product from another manufacturer:
 - a. Carlisle Coatings & Waterproofing Inc.; Sure-Seal EPDM.

2.3 DRAINAGE PANELS

- A. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. DuPont de Nemours, Inc.
 - c. Owens Corning.
 - d. The Dow Chemical Company.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.

2.4 AUXILIARY MATERIALS

- A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
- B. Sheet Flashing: Same material, construction, and thickness as sheet waterproofing, as required by manufacturer.
- C. Bonding Adhesives: For bonding waterproofing sheets and sheet flashings to substrates and projections.
- D. Lap Sealant: Single-component sealant.
- E. Water-Cutoff Mastic: Butyl mastic sealant.
- F. Waterproofing and Sheet-Flashing Accessories: Provide sealants, pourable sealers, cone and vent flashings, inside and outside corner flashings, termination reglets, and other accessories recommended by waterproofing manufacturer for intended use.

- G. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, prepunched, with fasteners.
- H. Protection Course: Semirigid sheets of asphalt-impregnated organic mat, mineral surface, with a nominal thickness of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 SURFACE PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- C. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- D. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
- E. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions.

3.3 FULLY ADHERED SHEET INSTALLATION

- A. Install fully adhered sheets over entire area to receive waterproofing according to manufacturer's written instructions and recommendations in ASTM D 5843.
- B. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required. Stagger end laps.
- C. Apply bonding adhesive to substrates at required rate and allow it to partially dry.
- D. Apply bonding adhesive to sheets and firmly adhere sheets to substrates. Do not apply bonding adhesive to splice area of sheet.
- E. Install fully adhered sheets and auxiliary materials to tie into existing waterproofing.
- F. Repair tears, voids, and lapped seams in waterproofing that do not comply with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending beyond repaired areas in all directions.

3.4 SEAM INSTALLATION

- A. Cement Splice: Clean splice areas, apply splicing cement and in-seam sealant, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to produce a splice not less than 6 inches (150 mm) wide and to ensure a watertight seam installation. Apply lap sealant and seal edges of sheet terminations.

3.5 SHEET-FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to waterproofing manufacturer's written instructions.
- B. Form wall flashings using exposed sheet flashing.
- C. Terminate and seal top of sheet flashings with mechanically anchored termination bars.

3.6 PROTECTION COURSE INSTALLATION

- A. Install protection course over waterproofing membrane according to manufacturer's written instructions and before beginning subsequent construction operations. Minimize exposure of membrane.
 - 1. Board insulation may be used in place of a separate protection course for vertical applications when approved by waterproofing manufacturer.

3.7 PROTECTION, REPAIR, AND CLEANING

- A. Protect waterproofing from damage and wear during remainder of construction period.
- B. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 1353

SECTION 07 1800 - TRAFFIC COATINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes traffic coatings and pavement markings for the following applications:
 - 1. Coating for Vehicular Traffic (Parking Garage)
 - 2. Waterproof Coating for Pedestrian Traffic (Mechanical Rooms)
 - 3. Liquid Floor Treatment for Pedestrian traffic (Equipment and Storage Rooms).
 - 4. Pavement Markings (Parking Garage, exterior concrete and asphalt parking areas and driveways).

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include installation instructions and details, material descriptions, dry or wet film thickness requirements, and finish.
- B. Shop Drawings: For traffic coatings.
 - 1. Include details for treating substrate joints and cracks, flashings, deck penetrations, and other termination conditions that are not included in manufacturer's product data.
- C. Samples for Verification: For each type of exposed finish, prepared on rigid backing.
 - 1. Provide stepped Samples on backing to illustrate buildup of traffic coatings.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For traffic coatings to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to set quality standards for materials and execution.
 - 1. Build mockup for each traffic coating and substrate to receive traffic coatings.

2. Size: 200 sq. ft. of each substrate to demonstrate surface preparation, joint and crack treatment, thickness, texture, color, and standard of workmanship.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Apply traffic coatings within the range of ambient and substrate temperatures recommended in writing by manufacturer. Do not apply traffic coatings to damp or wet substrates. Apply when temperatures are between 50 deg F and 90 deg F (10 deg C and 32 deg C). Do not apply when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F (-15 deg C) above dew point.
1. Do not apply traffic coatings in snow, rain, fog, or mist, or when such weather conditions are imminent during the application and curing period. Apply only when frost-free conditions occur throughout the depth of substrate.
 2. Use a surface thermometer to monitor, as necessary, the temperature of substrates to be patched and waterproofed.
- B. Do not install traffic coating until items that penetrate membrane have been installed.
- C. Conditions for Concrete: New concrete shall be in place a minimum 28 days before proceeding. Any cementitious repair mortars must have a full 7-day cure prior to coating unless otherwise approved in writing by architect.
1. Examination:
 - a. Prior to commencement of traffic coating application examine substrates, with Applicator present, for compliance with requirements and for other conditions affecting performance of system.
 - b. For the record, prepare written report, endorsed by Applicator, listing conditions detrimental to performance.
 - c. Verify compatibility with and suitability of substrates.
 - d. Contractor must report, in writing, surfaces left in improper condition by other trades. Application of coating indicates acceptance of surfaces and conditions.
- D. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials, and not exceeding 95 deg F.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace traffic coating that fails in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Adhesive or cohesive failures.
 - b. Abrasion or tearing failures.
 - c. Surface crazing or spalling.

- d. Intrusion of water, oils, gasoline, grease, salt, deicer chemicals, or acids into deck substrate.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations:

1. Obtain each traffic coating system from single source from single manufacturer.
2. Obtain primary traffic-coating materials, including primers, from traffic-coating manufacturer. Obtain accessory materials including aggregates, sheet flashings, joint sealants, and substrate repair materials of types and from sources recommended in writing by primary material manufacturer.
3. Obtain pavement-marking paint from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Material Compatibility: Provide primers; base coat, intermediate coat, and topcoat; and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. 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. Advanced Polymer Technology Corp.
 - b. Euclid Chemical Company (The); an RPM company.
 - c. Gaco; a brand of Firestone Building Products.
 - d. Instl-X Products; Benjamin Moore & Co.
 - e. Master Builders Solutions.
 - f. Neogard; Hempel Group.
 - g. PPG Paints; PPG Industries, Inc.
 - h. Pacific Polymers; ITW Polymers Sealants North America.
 - i. Pecora Corporation.
 - j. Polycoat Products.
 - k. Sherwin-Williams Company (The).

2.3 COATING FOR VEHICULAR TRAFFIC

- A. Traffic Coating: Traffic-bearing, seamless, high-solids-content, cold liquid-applied, elastomeric, water-resistant membrane system with integral wearing surface for vehicular traffic service condition; according to ASTM C957/C957M.
 1. Basis-of-Design Product: "Flexdeck System – Light Traffic System for Parking Structures" by Euclid Chemical.
 2. Provide named system or comparable system from one of the approved manufacturers.

- B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.
1. Material: Epoxy.
 2. Description: 100% solids, two-component, penetrating epoxy primer manufactured by Urethane Deck Coating System manufacturer.
 - a. Mixed Viscosity of 300 to 400 cps
 - b. Tack Free Time of 3 to 4 hours @ 75 deg F.
 - c. Cure Time of 12 hours @ 75 deg F
 - d. VOC: <5 g/L
- C. Waterproof Membrane:
1. Material: Urethane Membrane.
 2. Description: (2) component, 100% solids, elastomeric urethane manufactured by Urethane Deck Coating System manufacturer.
 - a. Tensile Strength 1,200 psi @ 7 days per ASTM D 412
 - b. Tensile Elongation: 350% per ASTM D 412
 - c. Tear Resistance: 100 pli per ASTM D 1004
- D. Topcoat:
1. Material: Urethane Top Coat.
 2. Description: (1) component, aliphatic urethane manufactured by Urethane Coating System manufacturer.
 - a. Tensile Strength: 2,500 psi per ASTM D 412
 - b. Tensile Elongation: 100% per ASTM D 412
 - c. Tear Resistance: 200 pli per ASTM D 1004
 - d. Abrasion Resistance: 0.010 loss CS 17 wheel, 1000 g.
 - e. Color: Tan
- E. Aggregate: 20/30 or 20/40 silica aggregate or as otherwise approved in writing by manufacturer of Urethane Deck Coating System.

2.4 WATERPROOF COATING FOR PEDESTRIAN TRAFFIC

- A. Liquid applied, high solids, moisture cured waterproof system with integral wearing surface for Mechanical and Boiler room floor and 4" up the walls; according to ASTM C957/C957M.
1. Basis-of-Design System: "Polydeck MR" by Polycoat Products, 48 Dry Mills thickness total for system.
 2. Provide named system only (owner's standard).
- B. Primer: Liquid primer as recommended in writing for substrate and conditions by traffic-coating manufacturer.
1. Material: Epoxy.
- C. Preparatory and Base Coats: Polyurethane.
- D. Topcoat: Aromatic Polyurethane

1. Aggregate Content: As required to achieve slip-resistant finish, but not more than the owner's standard. Consult with owner's representative prior to traffic coating installation to verify.
 2. Color: As selected by Architect from manufacturer's full range.
- E. Aggregate: Manufacturer's standard aggregate for each use indicated.
- F. Accessories: Accessory materials as recommended by manufacturer for products/systems listed.
1. Cant Bead: At floor-to-wall transition, provide cant bead (1/2" – 1" deep) with approved polyurethane sealant. All coats of waterproofing system shall continue across cant and up the wall 4"H.

2.5 LIQUID FLOOR TREATMENT FOR PEDESTRIAN TRAFFIC

- A. Liquid Densifier Sealer: High performance, deeply penetrating concrete densifier; odorless, colorless, VOC - compliant, non-yellowing silicate and siliconate based solution designed to harden, dustproof and protect concrete floors and to resist black rubber tire marks. The compound must contain a minimum solids content of 20% of which 50% is siliconate.
1. Basis-of-Design Product: "Euco Diamond Hard Liquid Densifier and Sealer for Concrete" by Euclid Chemical.
 2. Provide named system or comparable system from one of the approved manufacturers.

2.6 PAVEMENT MARKINGS

- A. Pavement-Marking Paint:
1. Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type F (fast dry); colors complying with FS TT-P-1952.
 2. Color: White, Yellow, and/or Blue. Prior to ordering materials, verify owner's standard pavement marking colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements and for other conditions affecting performance of urethane deck coatings.
1. Verify compatibility with and suitability of substrates.
 2. Begin coating application only after minimum concrete curing and drying period recommended by urethane deck coating manufacturer has passed, after unsatisfactory conditions have been corrected, and after surfaces are dry.
 3. After surface preparation, and just prior to the application, of the urethane deck coating system, verify that the substrate is visibly dry and free of moisture.
 - a. Test for moisture vapor transmission by plastic sheet method according to ASTM D 4263, modified to two hours. Do not apply coating if presence of moisture is indicated.

4. Application of coating indicates acceptance of surfaces and conditions.

3.2 PATCHING, CRACK REPAIRS AND DETAILS

- A. Prior to the application of urethane deck coating repair concrete as called for in Division 3.
- B. Prepare, treat, rout, and fill cracks in substrates according to ASTM C 1127 and manufacturer's written recommendations. Before coating surfaces, remove dust and dirt from joints and cracks according to ASTM D 4258.
 1. All cracks less than 1/16" in width shall be treated with a preparatory coat of Waterproof Membrane per manufacturer's written recommendations and ASTM C 1127, unless noted otherwise for specific product.
 2. All cracks greater than 1/16" in width shall be routed and sealed, per ASTM C 1127, with flexible urethane joint sealant recommended by Urethane/Epoxy Deck Coating System Manufacturer, unless noted otherwise for specific product.
 3. Comply with recommendations in ASTM C 1193 for joint-sealant installation.

3.3 SURFACE PREPARATION

- A. Clean and mechanically prepare substrates according to manufacturer's written recommendations to produce clean, sound, dust-free, dry, absorptive substrate free of grease, oils, curing compounds, surface laitance, soil and other contaminants which may interfere with bond of Coating System. Remove all concrete fins, ridges, and other projections. Surface profile should be equal to CSP 3 to 6 in accordance with ICRI Guideline 310.2.
- B. Prepare vertical and horizontal surfaces at terminations and penetrations through Coating System and at expansion joints, drains, and sleeves according to manufacturer's written recommendations
- C. Mask adjoining surfaces not receiving Urethane Deck Coating System, drains, and other substrate penetrations to prevent spillage, leaking, and migration of coatings.
- D. For liquid floor treatments, prepare concrete surfaces in accordance with manufacturer's written instructions.
 1. Ensure surfaces are clean, dry and free of standing water.
 2. Remove dirt, dust, oil, grease, sealers, and other materials that may prevent penetration of liquid densifier sealer.

3.4 URETHANE DECK COATING SYSTEM APPLICATION AT PARKING GARAGE:

- A. Mechanical Mixing- Coating and primers shall be mixed thoroughly utilizing a mechanical drill with a manufacturer approved mixing blade. Premix individual components separately per manufacturer's recommendations then combine materials and mix per manufacturers recommendations. Bottom and sides of container may be scraped during mixing but shall not be scraped once mixing has ceased. Do not aerate material.
- B. Primer Application: Apply uniform application of specified Epoxy Primer to properly prepared surface utilizing short nap roller, brush, or airless spray. Apply at manufacturer's recommended coverage rate of 200 to 250 square feet per gallon.

- C. Membrane Application: When epoxy primer is tack free, but no more than 24 hours after application of epoxy primer, apply uniform application of properly mixed Urethane Deck Coating System Membrane to surface utilizing a serrated squeegee, notched trowel, a magic trowel, or a short nap roller. Apply at a rate of 40 to 60 square feet per gallon per manufacturer's written recommendations. A spike roller shall be utilized to remove entrapped air prior to initial set of the Urethane Deck Coating System Membrane.
- D. Top Coat Application: Once the Membrane is tack free, but no longer than 24 hours after membrane application, apply one coat of Urethane Deck Coating System Tie Coat at manufacturer's recommended coverage rate of 100-150 sq. ft. per gallon.
 - 1. While Urethane Deck Coating System is still wet broadcast and backroll clean, dry silica aggregate at a rate of 0.25 to 0.75 lbs per square foot to obtain the desired non-slip finish.

3.5 LIQUID FLOOR TREATMENT APPLICATION

- A. Apply Liquid Densifier Sealer in strict accordance with the directions of the manufacturer. Spray, squeegee or roll on liquid to clean, dry concrete surface at a rate no greater than 225 sq. ft. per gallon. The liquid shall be scrubbed into the surface with a mechanical scrubber. Keep the surface wet for a minimum of 30 minutes with the Liquid Densifier Sealer during the application process. When the product thickens, but not more than 60 minutes after initial application, the surface shall then be squeegeed or vacuumed to remove all excess liquid.
 - 1. Do not leave any residue on surface.
 - 2. Do not track material on to untreated surfaces.

3.6 WATERPROOF COATING APPLICATION AT MECHANICAL ROOMS

- A. Floor and wall prep shall include scraping, sanding, and/or grinding, chipping loose concrete, patching holes, divots, and other voids to create good adhesion of product.
- B. Crack prep and sealing shall include:
 - 1. Grinding cracks in concrete that are wider than 1/16 inch with a diamond crack chasing wheel on a grinder,
 - 2. Crack clean out (loose concrete and dust),
 - 3. Installation of materials,
 - 4. Finishing with self-leveling polyurethane caulk to penetrate the floor and fill to level flush, flat, and smooth, with the floor surface.
 - 5. Installing backer rod first on cracks larger than 1/4" wide so as to avoid voids, and non-adhesion of caulk to substrate.
- C. Floor penetration treatment shall include sealing around any penetrations in the floor (i.e. ducts, pipes conduits, or any other means of water flowing through to the spaces below) with a good quality polyurethane caulk or other appropriate durable patch. Backer rod should be used where appropriate per manufacture specs.
- D. Radius treatment shall include removal of any loose material or other products that would prevent good adhesion, including paint; troweling of the epoxy cove product 3/4" radius, and any clean-up and finishing work.

- E. Floor coating shall include any further pre-paint clean-up, masking, site protection, venting, and application of coating, including 4" up the walls, housekeeping pads, vertical face, under equipment as much as possible, and post-paint clean-up.

3.7 CURING AND PROTECTING

- A. Prevent contamination and damage during application and curing stages.
- B. Protect Coating System from damage and wear during remainder of construction period.

3.8 INSTALLATION OF PAVEMENT MARKINGS

- A. Do not apply pavement-marking paint for striping and other markings until layout, colors, and placement have been verified with Architect and traffic coating has cured.
- B. Sweep and clean surface to eliminate loose material and dust.
- C. Apply pavement-marking paint with mechanical equipment to produce markings of dimensions indicated with uniform straight edges. Apply at manufacturer's recommended rates for a minimum wet-film thickness of 15-mils.
 - 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.9 FIELD QUALITY CONTROL

- A. Final Traffic-Coating Inspection: Arrange for traffic-coating manufacturer's technical personnel to inspect membrane installation on completion.
 - 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

3.10 PROTECTING AND CLEANING

- A. Protect traffic coatings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 1800

SECTION 07 1900 - WATER REPELLENTS

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 clear water-repellent coatings for the following surfaces:
 - 1. Exterior Concrete Masonry Units (CMU) not covered with veneer.
 - 2. Exterior masonry veneer at areas not scheduled to receive anti-graffiti coating (see 09 9000).

1.3 PERFORMANCE REQUIREMENTS

- A. Provide water repellents with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using same materials and application methods to be used for Project.
 - 1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
 - 2. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.
 - 3. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.
 - 4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 53.
 - 5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, per ASTM D 1653.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, recommendations for water repellents for each surface to be treated, and protection and cleaning instructions. Include data substantiating that the manufacturer recommends materials for applications indicated and will comply with requirements.
- B. Samples: Of each substrate indicated to receive water repellent, 12 inches (300 mm) square, with specified repellent treatment applied to half of each sample.
- C. Applicator Certificates: Signed by manufacturer certifying that the applicator complies with requirements.
- D. Certification by water repellent manufacturer that products supplied complies with local regulations controlling use of VOCs.

- E. Material Test Reports: Indicate and interpret test results for compliance of water repellents with requirements indicated.

1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator that employs only persons trained and approved by water repellent manufacturer for application of manufacturer's products.
- B. Testing Agency Qualifications: An independent testing agency with experience and capability to conduct testing indicated in "Performance Requirements" Article without delaying the Work, per ASTM E 548.
- C. Field Samples: Architect will select one representative surface for each substrate to receive water repellents. Apply water repellent to each substrate, with either partial or full coverage as directed. Comply with application requirements of this Section.
 - 1. Obtain Architect's approval of field samples before applying water repellents.
 - 2. Maintain field samples during construction in an undisturbed condition as a standard for judging the completed Work.

1.6 PROJECT CONDITIONS

- A. Weather and Substrate Conditions: Do not proceed with application of water repellent under any of the following conditions, except with written instruction of manufacturer:
 - 1. Ambient temperature is less than 40 deg F (4.4 deg C).
 - 2. Mortar has cured for less than 28 days.
 - 3. Rain or temperatures below 40 deg F (4.4 deg C) are predicted within 24 hours.
 - 4. Application is earlier than 24 hours after surfaces have been wet.
 - 5. Substrate is frozen or surface temperature is less than 40 deg F (4.4 deg C).
 - 6. Windy condition exists that may cause water repellent to be blown onto vegetation or surfaces not intended to be coated.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty, executed by the applicator and water repellent manufacturer, covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the specified warranty period. Warranty does not include deterioration or failure of coating due to unusual weather phenomena, failure of prepared and treated substrate, formation of new joints and cracks in excess of 1/16 inch (1.5 mm) wide, fire, vandalism, or abuse by maintenance equipment.
 - 1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. Siloxanes: With 3.3 lb/gal. (400 g/L) VOCs or less. (Contractor verify VOC compliance)
 - a. A-H Aridsil VOC; Anti Hydro International, Inc.
 - b. Prime A Pell H₂O; Chemprobe Technologies, Inc.
 - c. Diedrich 303S-15 Silox Seal; Diedrich Technologies, Inc.
 - d. Hydrozo Clear 16; Harris Specialty Chemicals, Inc.
 - e. Shed OX WB; L&M Construction Chemicals, Inc.
 - f. Weather Seal Siloxane WB; ProSoCo, Inc.
 - g. Masonry Saver WB; SaverSystems Div. of Meredith, Inc.
 - h. Baracade ME; Tamms Industries Co.

2.2 WATER REPELLENTS

- A. Siloxanes: Penetrating water repellent. Alkylalkoxysiloxanes that are oligomeric with alcohol, ethanol, mineral spirits, water, or other proprietary solvent carrier.
- B. VOC Compliance: Products to be provided must comply with current VOC regulations. Products used on interior must be formulated to produce little or no perceptible odor.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to repellent manufacturer's written instructions, to ensure surface is sufficiently dry.
- B. Test for pH level, according to water repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.
- C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live plants and grass.
- D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.
- E. Test Application: Before performing water-repellent work, including bulk purchase and delivery of products, prepare a small application in an unobtrusive location and in a manner approved by Architect to demonstrate the final effect (visual, physical, and chemical) of planned application. Proceed with work only after Architect approves test application or as otherwise directed.

1. Revisions of planned application, if any, as requested by Architect, will be by Change Order if they constitute a departure from requirements of Contract Documents at the time of contracting.

3.2 APPLICATION

- A. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
- B. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult the manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Provide services of a factory-authorized technical service representative to inspect and approve the substrate before application and to instruct the applicator on the product and application method to be used.

3.4 CLEANING

- A. Protective Coverings: Remove protective coverings from adjacent surfaces and other protected areas.
- B. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

END OF SECTION 07 1900

SECTION 07 2100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board insulation
 - a. At foundation walls and below slab on grade at perimeter.
 - b. Below plaza paving system (where occupied spaces occur below plaza).
 - c. Below concrete topping slabs (at overbuild areas)
 - 2. Extruded polystyrene foam-plastic board insulation with wood fiber exposed faces
 - a. At parking garage concrete deck, where occupied spaces occur above garage.
 - 3. Polyisocyanurate foam-plastic board insulation
 - a. Behind metal wall panel systems.
 - b. Behind glazed spandrel panel systems.
 - 4. Glass-fiber blanket insulation
 - a. Acoustical insulation at interior walls as noted in drawings.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Polyisocyanurate foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. DuPont de Nemours, Inc.
 - c. Owens Corning.
 - d. The Dow Chemical Company.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION WITH WOOD FIBER EXPOSED FACES

- A. Composite Panel consisting of Extruded Polystyrene Board (EPS) Insulation of type listed in Article 2.1, laminated to 1-1/2" wood fiber facing material.
- B. Basis-of-Design Product: Tectum Composite Panel by Armstrong World Industries.
- C. Thickness: Overall panel thickness: 3-1/2-inches for R-10 minimum..
 1. EPS Insulation: 2-inches
 2. Wood Fiber (Tectum) panel: 1-1/2-inches.
- D. Panel Size: 4'-0" X 8'-0" typical with beveled edges. Custom panels needed at edges of installation – refer to reflected ceiling plans.
- E. Mounting: Composite Panels back-mounted to drywall grid system. Drywall grid system mounted to concrete deck. No exposed fasteners shall be visible and panels shall butt tight to each other for no gaps in system.
 1. Basis-of-Design: Drywall Grid System by Armstrong with QSUTC "Uptight" Clip for composite panel location 1-1/2" total below concrete slab.
 2. See Specification 092216 for additional information on suspension systems.

2.3 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Faced: ASTM C1289, Type I, Class 1 or 2, complying with ASTM E84 for Flame Spread 25 or less and Smoke Developed of <450. Tested per NFPA 285 to comply with IBC Section 2603.5.5.

1. Basis-of-Design Product: ECOMAXci FR Air Barrier system by Rmax, Inc. Provide basis of design product or an equivalent product from one of the approved manufacturers listed.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Polyiso Roof and Wall Insulation.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. DuPont de Nemours, Inc.
 - d. Firestone Building Products.
 - e. Johns Manville; a Berkshire Hathaway company.
 - f. Rmax, Inc.
 - g. The Dow Chemical Company.

2.4 GLASS-FIBER BLANKET INSULATION

- A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
- B. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Certainteed; SAINT-GOBAIN.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.

2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors (at spandrel glass locations): Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 - 1. Angle: Formed from 0.030-inch-thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 - 2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

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

3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.

3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - a. Exterior Walls: Set units with facing placed toward exterior of construction.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

3.7 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
 2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 3. Install insulation to fit snugly without bowing.

3.8 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 07 2413 - POLYMER-BASED EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. EIFS-clad barrier-wall assemblies that are field applied over substrate for walls and soffits.

1.3 DEFINITIONS

- A. Definitions in ASTM E2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.
- D. Polymer-Based Exterior Insulation and Finish System: Class PB EIFS, as defined in ASTM E2568.

1.4 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory.
- B. Shop Drawings: For prefabricated EIFS panels.
 - 1. Include plans, elevations, sections, details of components including build-outs, details of penetrations and terminations, flashing details, joint locations and configurations, lifting points, fastening and anchorage details including mechanical fasteners, and connections and attachments to other work.
- C. Samples: For each exposed product and for each color and texture specified, 8 inches square in size.
- D. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
 - 1. Include similar Samples of exposed accessories involving color selection.
- E. Samples for Verification: 24-inch-square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work, including custom trim, each profile, and an aesthetic reveal.
 - 1. Include exposed trim and accessory Samples to verify color selected.

2. Include a typical control joint filled with sealant of color selected, as specified in Section 07 9200 "Joint Sealants."

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by EIFS manufacturer, certifying the following:
 1. EIFS substrate is acceptable to EIFS manufacturer.
 2. Accessory products installed with EIFS, including joint sealants flashing, water-resistant barriers, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- C. Product Certificates: For cementitious materials and aggregates and for insulation, from manufacturer.
- D. Product Test Reports: For each EIFS assembly and component, for tests performed by a qualified testing agency.
- E. Field quality-control reports.
- F. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by AWCI International as qualified to install Class PB EIFS using trained workers.
- B. Fabricator/Erector Qualifications: Certified in writing by EIFS manufacturer as qualified to fabricate and erect manufacturer's prefabricated panel system using skilled and trained workers.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
 1. Stack insulation board flat and off the ground.
 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.
1. Proceed with installation of adhesives or coatings only when ambient temperatures have remained, or are forecast to remain, above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after application. Do not apply EIFS adhesives or coatings during rainfall.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Bond integrity and weathertightness.
 - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
 2. Warranty coverage includes the following EIFS components:
 - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
 - b. Insulation installed as part of EIFS, including buildouts.
 - c. Insulation adhesive and mechanical fasteners.
 - d. EIFS accessories, including trim components and flashing.
 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. BASF Corporation.
 2. Dryvit Systems, Inc.
 3. Master Wall Inc.
 4. Pleko LLC.
 5. Stuc-O-Flex International, Inc.
 6. Total Wall, Inc.
- B. Source Limitations: Obtain EIFS from single source from single EIFS manufacturer and from sources approved by EIFS manufacturer as tested and compatible with EIFS components.

2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E2568 and with the following:

1. Weathertightness: Resistant to water penetration from exterior.
2. System Fire Performance: Fire-resistance rating of wall assembly.
3. Structural Performance of Assembly and Components:
 - a. Wind Loads: Uniform pressure as indicated on Drawings.
4. Impact Performance: ASTM E2568, High impact resistance unless otherwise indicated.
5. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch-thick EIFS mounted on 1/2-inch-thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts of sand when tested according to ASTM D968, Method A.
6. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D3273 and evaluated according to ASTM D3274.
7. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - a. Temperature Change: 100 deg F.

2.3 EIFS MATERIALS

- A. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- B. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; compatible with substrate and complying with the following:
 1. Factory-mixed noncementitious formulation designed for adhesive attachment of insulation to substrates of type indicated, as recommended by EIFS manufacturer.
- C. Molded, (Expanded) Rigid Cellular Polystyrene Board Insulation: Comply with ASTM E2430/E2430M, unless otherwise noted, and the following:
 1. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E84.
 2. Dimensions: Provide insulation boards of not more than 24 by 48 inches, with thickness indicated on Drawings.
 3. Foam Buildouts: Provide with profiles and dimensions indicated on Drawings.
- D. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multi-end strands with retained mesh tensile strength of not less than 120 lbf/in. according to ASTM E2098/E2098M and the following:
 1. Reinforcing Mesh for EIFS, General: Not less than weight required to comply with impact-performance level specified in "Performance Requirements" Article.
 2. Strip-Reinforcing Mesh: As recommended by EIFS manufacturer.
 3. Detail-Reinforcing Mesh: As recommended by EIFS manufacturer.
 4. Corner-Reinforcing Mesh: As recommended by EIFS manufacturer.
- E. Base Coat: EIFS manufacturer's standard mixture complying with the following:
 1. Factory-mixed noncementitious formulation of polymer-emulsion adhesive and inert fillers that is ready to use without adding other materials.

- F. Water-Resistant Base Coat: EIFS manufacturer's standard waterproof formulation complying with the following:
 - 1. Job-mixed formulation of portland cement complying with ASTM C150/C150M, Type I, white or natural color; and manufacturer's standard polymer-emulsion adhesive designed for use with portland cement.
- G. Mechanical Fasteners: EIFS manufacturer's standard corrosion-resistant fasteners, consisting of thermal cap, standard washer and shaft attachments, and fastener indicated below; designed to resist Project's design loads; capable of pulling fastener head below surface of insulation board; and complying with the following:
 - 1. For attachment to steel studs from 0.033 to 0.112 inch in thickness, provide steel drill screws complying with ASTM C954.
 - 2. For attachment to light-gage steel framing members not less than 0.0179 inch in thickness, provide steel drill screws complying with ASTM C1002.
 - 3. For attachment to wood framing members and plywood sheathing, provide steel drill screws complying with ASTM C1002, Type W.
 - 4. For attachment to masonry and concrete substrates, provide sheathing dowel in form of a plastic wing-tipped fastener with thermal cap, sized to fit insulation thickness indicated and to penetrate substrate to depth required to secure anchorage.
 - 5. For attachment to other substrates, provide manufacturer's standard fasteners suitable for substrate.
- H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- I. Finish Coat: EIFS manufacturer's standard acrylic-based coating complying with the following:
 - 1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
 - 2. Colors: As selected by Architect from manufacturer's full range.
 - 3. Textures: As selected by Architect from manufacturer's full range.
- J. Sealer: Manufacturer's waterproof, clear acrylic-based sealer for protecting finish coat.
- K. Water: Potable.
- L. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D1784 and ASTM C1063.
 - 1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
 - 2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation, with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg. (Clark Dietrich or equivalent).
 - 3. Expansion Joint: Closed-cell polyethylene backer rod and elastomeric sealant, 3/4-inch minimum.
 - 4. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.

5. Parapet Cap Flashing: Type for both flashing and covering parapet top, with design complying with ASTM C1397 and ANSI/SPRI/FM 4435/ES-1.

2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials, except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
 1. Begin coating application only after surfaces are dry.
 2. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind EIFS and deterioration of substrates.
- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
 1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

3.3 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C1397, ASTM E2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate.

3.4 SUBSTRATE PROTECTION APPLICATION

- A. Flexible-Membrane Flashing: Apply and lap to shed water; seal at openings, penetrations, and terminations. Prime substrates with flashing primer if required and install flashing.

3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at windowsills, and elsewhere as indicated. Coordinate with installation of insulation.
 - 1. Drip Screed/Track: Use at bottom edges of EIFS unless otherwise indicated.
 - 2. Windowsill Flashing: Use at windows unless otherwise indicated.
 - 3. Expansion Joint: Use where indicated on Drawings.
 - 4. Casing Bead: Use at other locations.
 - 5. Parapet Cap Flashing: Use where indicated on Drawings.

3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively and mechanically attach insulation to substrate in compliance with ASTM C1397 and the following:
 - 1. Sheathing: Apply adhesive to insulation by notched-trowel method in a manner that results in coating the entire surface of sheathing with adhesive once insulation is adhered to substrate. Apply adhesive to a thickness of not less than 1/4 inch for factory mixed and not less than 3/8 inch for field mixed, measured from surface of insulation before placement.
 - 2. Concrete or Masonry: Apply adhesive by ribbon-and-dab method.
 - 3. Press and slide insulation into place. Apply pressure over entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
 - 4. Allow adhered insulation to remain undisturbed for not less than 24 hours, before installing mechanical fasteners, beginning rasping and sanding insulation or before applying base coat and reinforcing mesh.
 - 5. Mechanically attach insulation to substrate. Install top surface of fastener heads flush with plane of insulation. Install fasteners into or through substrates with the following minimum penetration:
 - a. Steel Framing: 5/16 inch.
 - b. Wood Framing: 1 inch.
 - c. Concrete and Masonry: 1 inch.
 - 6. Apply insulation over dry substrates in courses, with long edges of boards oriented horizontally.
 - 7. Begin first course of insulation from a level base line and work upward.
 - 8. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
 - 9. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints, so no piece of insulation is less than 12 inches wide or 6 inches high. Offset joints not less than 6 inches from corners of window and door openings and not less than 4 inches from aesthetic reveals.
 - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches from horizontal and 4 inches from vertical joints in sheathing.
 - b. Mechanical Attachment: Offset joints of insulation from horizontal joints in sheathing.

10. Interlock ends at internal and external corners.
 11. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
 12. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
 13. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/16 inch from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch. Prevent airborne dispersal and immediately collect insulation raspings or sandings.
 14. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch.
 15. Install foam buildouts and attach to structural substrate by adhesive and mechanical fastening.
 16. Interrupt insulation for expansion joints where indicated.
 17. Form joints for sealant application by leaving gaps between adjoining insulation edges and between insulation edges and dissimilar adjoining surfaces. Make gaps wide enough to produce joint widths indicated after encapsulating joint substrates with base coat and reinforcing mesh.
 18. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
 19. Before installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not less than 2-1/2 inches over front and back face unless otherwise indicated on Drawings.
 20. Treat exposed edges of insulation as follows:
 - a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
 - b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
 - c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.
 21. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and EIFS lamina.
- B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:
1. At expansion joints in substrates behind EIFS.
 2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
 3. At floor lines in multilevel wood-framed construction.
 4. Where wall height or building shape changes.
 5. Where EIFS manufacturer requires joints in long continuous elevations.
 6. Where panels abut one another.

3.7 BASE-COAT APPLICATION

- A. Water-Resistant Base Coat: Apply full-thickness coverage to exposed insulation and to exposed surfaces of sloped shapes, window sills, parapets, foam buildouts and to other surfaces indicated on Drawings.

- B. Base Coat: Apply full coverage to exposed insulation and foam buildouts with not less than 1/16-inch dry-coat thickness.
- C. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- D. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C1397 in same manner as first application. Do not apply until first base coat has cured.
- E. Additional Reinforcing Mesh: Apply strip-reinforcing mesh around openings, extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip-reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch-wide, strip-reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.
 - 1. At aesthetic reveals, apply strip-reinforcing mesh not less than 8 inches wide.
 - 2. Embed strip-reinforcing mesh in base coat before applying first layer of reinforcing mesh.
- F. Foam Buildouts: Fully embed reinforcing mesh in base coat.
- G. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

3.8 FINISH-COAT APPLICATION

- A. Primer: Apply over dry base coat.
- B. Finish Coat: Apply full-thickness coverage over dry primed base coat, maintaining a wet edge at all times for uniform appearance, to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
 - 1. Embed aggregate in finish coat to produce a uniform applied-aggregate finish of color and texture matching approved sample.
- C. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by EIFS manufacturer.

3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. As stipulated in Ch. 17 of the IBC.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: According to ASTM E2568.

- D. EIFS will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 07 2413

SECTION 07 2500 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building paper
 - a. To be used at walls with metal panel cladding systems, as noted in the drawings.
 - b. To be used at substrates not covered by spray-applied building insulation or faced board insulation.
 - 2. Flexible flashing (to be used around door and window openings, typ.)

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.
- B. Shop Drawings: Show details of building paper at terminations, openings, and penetrations. Show details of flexible flashing applications.

1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For water-resistive barrier and flexible flashing, from ICC-ES.

PART 2 - PRODUCTS

2.1 WATER AND AIR BARRIER

- A. Basis-of-Design Product: "Tyvek Commercial Wrap D" by Dupont.
 - 1. Provide named product or equivalent product by another manufacturer.
 - 2. Install over sheathing at areas not scheduled to receive spray-applied or faced board insulation.
 - 3. Install over sheathing at Metal Wall and Soffit Panel Systems to protect substrate from exposure – see notes in the drawings.

2.2 FLEXIBLE FLASHING

- A. Rubberized-Asphalt Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.
 - 1. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
 - 2. Install around window and door openings at ACM (Aluminum Composite Material) panel locations and Brick Masonry Veneer locations.
- B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

PART 3 - EXECUTION

3.1 WATER AND AIR BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
 - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
 - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- A. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
 - 1. Seal seams, edges, fasteners, and penetrations with tape.
 - 2. Extend into jambs of openings and seal corners with tape.

3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing to comply with manufacturer's written instructions and as follows:
 - 1. Prime substrates as recommended by flashing manufacturer.
 - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
 - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
 - 4. Lap water-resistive barrier over flashing at heads of openings.
 - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrate.

END OF SECTION 07 2500

SECTION 07 2600 - UNDER-SLAB VAPOR RETARDER

PART 1 – GENERAL

1.1 SUMMARY

- A. Products Supplied Under This Section
 - 1. Vapor retarder, seam tape, mastic, and pipe boots for installation under concrete slabs.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 1745- 11 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
 - 2. ASTM E 154- 08 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 - 3. ASTM F 1249-06 (2011) Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
 - 4. ASTM D 882-10 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 5. ASTM D 1709-09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
 - 6. ASTM E 1643- 11 Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
- B. American Concrete Institute (ACI):
 - 1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

- A. Quality Control / Assurance
 - 1. Manufacturer's samples, literature
 - 2. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Vapor Retarder must have all of the following qualities:
 - 1. Maintain permeance of less than 0.01 perms [grains/(ft² · hr · inHg)] as tested in accordance with conditioning tests per ASTM E 1745 Section 7.1.1-7.1.5.
 - 2. Other performance criteria:
 - a. Strength: ASTM E 1745 Class A.
 - b. Thickness: 15 mils minimum
- B. Basis-of-Design Product:
 - 1. Stego Wrap, 15 mil thickness.

- C. Other Approved Products:
 - 1. Perminator, 15 mil thickness, by W.R. Meadows
 - 2. Vaporcheck II 15 mil thickness, by Viper II

2.2 ACCESSORIES

- A. Seam Tape:
 - 1. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96
- C. Vapor Proofing Mastic:
 - 1. Permeance less than 0.3 perms per ASTM F 1249 or ASTM E 96
- E. Pipe Boots
 - 1. Construct pipe boots from vapor retarder material, pressure sensitive tape and/or mastic per manufacturer's instructions.
- F. Perimeter Edge/Seal
 - 1. Provide products to terminate the vapor retarder at the perimeter of the building per installation standard ASTM E 1643.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.
 - 1. Level and tamp or roll aggregate, sand or granular base.

3.2 INSTALLATION

- A. Install vapor retarder in accordance with manufacturer's instructions and ASTM E 1643-98 (2005).
 - 1. Unroll vapor retarder with the longest dimension parallel with the direction of the concrete pour.
 - 2. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.
 - 3a. Seal vapor retarder to slab perimeter/edge using Stego Crete Claw (Proprietary Product) and remove dirt, debris, and mud from Crete Claw prior to concrete placement.
 - OR
 - 3b. Seal vapor retarder to footing/grade beam with double sided tape, termination bar, or both.
 - 4. Overlap joints 6 inches and seal with manufacturer's tape.
 - 5. Seal all penetrations (including pipes) per manufacturer's instructions.
 - 6. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
 - 7. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION 07 2600

SECTION 07 4213 - METAL WALL PANELS

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 SECTION INCLUDES

- A. Manufactured exterior wall panels and subgirt framing assembly, with related flashings and accessory components.
- B. Installation of weather-resistant air barrier and insulation as part of a complete rainscreen assembly.

1.03 RELATED REQUIREMENTS

- A. None

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review of procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 SUBMITTALS

- A. Product Data - Metal Panels: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, finishes, and:
 - 1. Panel manufacturer's data sheet showing physical and performance characteristics.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty for finish.
- B. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, method of anchorage, number of anchors, supports, reinforcement, trim, flashings, and accessories.
 - 1. Indicate substrates, water-resistant air barrier, insulation, and adjacent work with which the rainscreen system must be coordinated.
 - 2. Include large-scale details of anchorages and connecting elements.
 - 3. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing, drainage system, and rainscreen interface at a scale of not less than 1-1/2 inches per 12 inches (1:10).
 - 4. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

- C. Shop drawing shall be approved by architect in writing prior to fabrication.
- E. Selection Samples: For each finish product specified, submit at least three sample color chips representing manufacturer's standard range of available colors and patterns.
- F. Samples for Verification: For each finish product, prepared on Samples of size indicated below:
 - 1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- G. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.
- H. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
- I. Designer's Qualification Statement.
- J. Manufacturer's Qualification Statement.
- K. Installer's Qualification Statement.
- L. Maintenance Data: Care of finishes and warranty requirements.
- M. Warranty Documentation for Metal Panel Finish Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name.
- N. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum five years of documented experience and approved by manufacturer.

1.07 MOCK-UP

- A. Construct mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
- B. Locate where directed by Architect.
- C. Mock-up may remain as part of the Work if approved by Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.
- B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.
- C. Prevent contact with materials that may cause discoloration or staining of products.

1.09 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal panels by field measurements before fabrication.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.
- B. Coordinate sizes and locations of windows, doors and wall penetrations with actual systems provided.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing or perforating.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: 2 years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, chipping, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Basis of Design:
 - 1. Metal Wall Panels - Concealed Fasteners:
 - a. Uneek Summit 40 Wall Panel System: www.uneekinc.com.

2.02 METAL PANEL SYSTEM

- A. Metal Panel System: Factory fabricated prefinished metal panel system, site assembled.
 - 1. Provide exterior wall panels and sub girt framing assembly.
 - 2. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
 - 3. Anchor panels to supporting framing without exposed fasteners.

2.03 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
 - 1. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
 - 2. Design Pressure: In accordance with applicable codes.
 - 3. Maximum Allowable Deflection of Panel: $L/180$ for length(L) of span.
- B. Air Infiltration: 0.06 cfm/sq ft (0.003 L/s/sq m) of wall area, maximum, when tested at 6.24 psf (0.300 kPa) in accordance with ASTM E283.
- C. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
 - 1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
 - 2. Design to drain leakage and condensation to the exterior face of the wall.
- D. Thermal Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
- E. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

2.04 CONCEALED FASTENER METAL PANELS

- A. Exterior Wall Panels:
 - 1. Profile: Flat pans with flush seams.

2. Panel Orientation as indicated on Drawings.
 3. Configuration: Panel widths of 8, 12, and 16 inches; custom as shown on Drawings, with interlocking seams incorporating concealed anchor clips allowing thermal movement.
 4. Panel Depth: 1 inch (25 mm).
 5. Anchor Clip: 18 ga steel, designed to allow for thermal movement.
 6. Reveal Joint: As indicted on Drawings. Maximum 1 inch.
 7. Panel Length: As indicated on Drawings. Minimum 3 feet to Maximum 21 feet.
 8. Material: Precoated aluminum sheet, .040 and .050 aluminum.
 9. End Fold Option: Factory formed end fold on each end of the panels to create a Box Pan to allow for consistent reveal on all side of the panel.
 10. Internal and External Corners: Same material, thickness, and finish as exterior sheets; factory mitered; profile to suit system.
- B. Soffit Panels:
1. Profile: Flat pans with flush seams.
 2. Material: Precoated aluminum sheet, .040 and .050 aluminum.
- C. Expansion Joints: Same material, thickness and finish as exterior sheets; of profile to suit system.
- D. Anchors: Galvanized steel.

2.05 SUBGIRT FRAMING ASSEMBLY

- A. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
 2. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275.

2.06 MATERIALS

- A. Precoated Aluminum Sheet: ASTM B209 (ASTM B209M), 3105 alloy, O temper, smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.
- B. Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

2.07 FINISHES

- A. Pre-painted.
- B. Anodized.
- C. Panel Backside Finish: Panel manufacturer's standard wash coat.

2.08 ACCESSORIES

- A. Panel Accessories: Provide components required for a complete, Rainscreen panel system including trim, copings, corner units, clips, flashings, closures, sealants, fillers, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, head, sills, corners, jambs, framed openings, fasciae, parapet caps, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Field Touch-up Paint: As recommended by panel manufacturer.
- D. Bituminous Paint: Asphalt base.

2.09 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine dimensions, tolerances, and interfaces with other work.
- B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.
- C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Install water-resistant air barrier system, refer to Section 07 2500 for requirements.
- B. Install insulation, refer to Section 07 210 for requirements.
- C. Install subgirt framing perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated on approved shop drawings.

3.03 INSTALLATION

- A. Install panels in accordance with manufacturer's instructions and approved shop drawings.
- B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.
- C. Fasten panels to structural supports using Clips; spacing not to exceed 32 inches, aligned, level, and plumb.
- D. Locate joints over supports.
- E. Provide expansion and control joints where indicated.
- F. Use concealed fasteners unless otherwise approved by Architect.
- G. Coordinate flashing and sheet metal work to provide weathertight conditions at wall terminations. Fabricate in accordance with SMACNA Manual.

- H. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

3.04 TOLERANCES

- A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).
- B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6.4 mm).

3.05 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- D. Prepare test and inspection reports.

3.06 CLEANING

- A. Remove site cuttings from finish surfaces.
- B. Remove protective material from wall panel surfaces.
- C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.
- D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.
- E. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 5419 - PVC MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Mechanically fastened membrane roofing system installed over insulated deck.
 - 2. Mechanically fastened insulation of thicknesses required to achieve thickness and drainage slope noted.
 - 3. Warranty information.
 - 4. Clipping of fasteners where exposed to view.
- B. Roof work shall be constructed to be free of non-draining areas, with positive slope to drain, under all conditions. Acceptance by the manufacturer of such standing water areas, low spots, wrinkles or other conditions that retain water under their listing guidelines shall have no bearing on the Architect or Owner's requirements to accept conditions that are deemed not to be acceptable. Such defects that create areas not suited to free drainage shall be cause for rejection of the installation until corrected.
- C. Factory fabricated components may require modification to achieve positive drainage, to comply with specific project requirements for dimensional limitations and slopes to drain.

1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.
- B. Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," before multiplication by a safety factor.
- C. Factored Design Uplift Pressure: The uplift pressure, calculated according to procedures in SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems," after multiplication by a safety factor.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- B. General Performance: Installed membrane roofing, walkways and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction.

- C. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, and demonstrated by membrane roofing manufacturer based on testing and field experience.
- D. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.
- E. FMG Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FMG Approvals 4450 and FMG Approvals 4470 as part of a membrane roofing system. Identify materials with FMG Approvals markings.
 - 1. Fire/Windstorm Classification: Class 1A 90. 72 mph wind speed. SH Hail rating.

1.5 SUBMITTALS

- A. General: Contractor to maintain each item in this Article according to the conditions of the Contract and Division 1 Specification Sections.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other Work.
 - 1. Base flashings and membrane terminations.
 - 2. Tapered insulation, including slopes.
 - 3. Insulation fastening patterns.
 - 4. Roof sump detail showing coordination with roof drains.
- D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install roofing system.
- E. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - 1. Submit evidence of meeting performance requirements.
- F. Maintenance Data: For roofing system to include in maintenance manuals.
- G. Warranties: Special warranties specified in this Section.
- H. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.
- B. Source limitations: Obtain components including fasteners for membrane roofing system approved by Owner and/or membrane roofing manufacturer.
- C. Exterior Fire Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

- D. Membrane shall contain an average of 10% recycled vinyl content verified by UL claims validation of recycled content.
- E. Pre-installation Roofing Conference: Conduct conference at project site.
 - 1. Meet with owner, roofing installer, roofing system technical manufacturer's representative, and installers whose work interfaces with or affects roofing.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
 - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays. Installers shall provide their own restroom facility. Installers will also provide their own source of electrical power.
 - 4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
 - 5. Review structural loading limitations of roof deck during and after roofing.
 - 6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
 - 7. Review governing regulations and requirements for insurance and certificates if applicable.
 - 8. Review temporary protection requirements for roofing system during and after installation.
 - 9. Review roof observation and repair procedures after roofing installation.
- F. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's warranty prior to receipt of bids.
 - 1. A minimum of five years experience is required on similar sized projects.
- G. Fire Test Response Characteristics: Provide membrane roofing materials with the fire test response characteristics indicated as determined by testing identical products per test method below by UL, FMG, or another testing and inspecting agency acceptable to authorities having jurisdiction. Materials shall be identified with appropriate markings of applicable testing and inspecting agency.
 - 1. Exterior Fire Test Exposure: Class A ; ASTM E 108, for application and roof slopes indicated.
 - 2. Fire Resistance Ratings: ASTM E 119, for fire resistance rated roof assemblies of which roofing system is a part.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store materials in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

- D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

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

1.9 WARRANTY

- A. Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.
 - 1. No exclusions for ponding water.
 - 2. Roofing Membrane Manufacturer's Special Warranty includes membrane roofing, base flashings, air/vapor barrier, fasteners, substrate board, roofing accessories, and other components of membrane roofing system purchased from the manufacturer.
 - 3. Warranty Period: 20 years from the date of Substantial Completion + additional 5-year warranty, for a total of **25 years**.
 - 4. Provide a wind speed warranty of up to 90 mph.
- B. Contractors Warranty: Submit roofing installer's warranty, on warranty form approved by Owner, Signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, fasteners, substrate boards, and walk-way products, for the following warranty period:
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 ROOFING MEMBRANE

- A. PVC/KEE Sheet: ASTM D 4434. Type III or ASTM 6754, fabric reinforced. Membrane must be manufactured by the company supplying the warranty (no private labeling) with a minimum successful track record of directly producing PVC membranes that is equal to warranty period issued. Membrane must have documentation of the authenticity of said successful track record, and be located in the same geographical region as the project that said membrane would be installed on. Membrane should have the same basic formulation within said successful track record.
 - 1. Manufacturers: Subject to compliance with requirements
 - 2. Thickness: **80 mils** minimum, with a minimum of **38 mils** of polymer above reinforcing scrim. Nominal sheets will not be accepted. Membrane type shall meet manufacturer requirements for use below ballasted photovoltaic (PV) systems.
 - 3. Exposed face color: **White**
 - 4. Attachment method: "RhinoBond" Plates and fastening system, or equivalent.
- B. Roofing system must be listed on the DOE's Energy Star "Roof Product Qualified Product List" for low slope roof products.

2.2 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
 - 1. Liquid type auxiliary materials shall meet VOC limits of authorities having jurisdiction.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as sheet membrane. Flashing 60 mils thick minimum, of same color as sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard solvent based bonding adhesive for base flashings.
- D. Metal Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 2-1/4" by 1/8 inch (25 by 3 mm) thick; C shaped with sealant shelf and anchors. **Flat termination bars will not be accepted.**
- E. Metal Battens: Manufacturer's standard aluminum zinc alloy coated or zinc coated steel sheet, approximately 1 inch (25 mm) wide by 0.05 inch (1.3 mm) thick, pre-punched.
- F. Coated Flashings: Manufacturer's standard coated metal flashings in thickness as recommended by manufacturer for indicated use and complying with performance requirements, but with metal thickness not less than 0.028 inches.
- G. Fasteners: Factory coated steel fasteners and metal or plastic plates meeting corrosion resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T joint covers, termination reglets, cover strips, and other accessories.
- I. Transition flashings compatible with membrane and an air barrier system installed as required to maintain continuous barrier system as required by code.
- J. Slip Sheets: Provide protection sheets, matching membrane type used on field of roof, with a minimum **60 mil thickness**, below solar racking or mounting systems, each ballast pan, rail, or other PV system component in contact with the roofing membrane. Consult manufacturer's "Photovoltaic Installation / Warranty Policy" and comply with all requirements.

2.3 ROOF INSULATION

- A. General: Provide preformed roof insulation boards that comply with requirements and referenced standards, selected from manufacturer's standard sizes and of thicknesses indicated. R-30 minimum.
- B. High-Density Polyisocyanurate Board Insulation: ASTM C 1289, Type II, R-30 felt or glass fiber mat facer on both major surfaces as required for mechanically fastened, warranted application under photovoltaic (PV) systems.
 - 1. Available Manufacturers include the following:
 - a. Sika Corporation
 - b. AlliedSignal Inc.; Commercial Roofing Systems.
 - c. Atlas Roofing Corporation.
 - d. Hunter Panels, LLC.

- C. Tapered Insulation: Provide factory tapered insulation boards fabricated to a minimum slope of 1/4 inch per 12 inches or as required to provide a minimum slope of 1/8 inch per 12 inches in valleys. 1.5# minimum EPS is permitted in sloped applications.
- D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.4 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.
- B. Fasteners: Factory coated steel fasteners and metal meeting corrosion resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.
- C. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.
- D. Slip Sheets: Manufacturer's recommended slip sheet, of type required for application to separate membrane from insulating substrate under Alternate Insulation applications.

2.5 AIR/VAPOR BARRIER

- A. At steel roof deck locations: 31 mil. thick, self-adhesive vapor/air barrier composed of SBS modified bitumen. Must be able to maintain exposure for up to 3 months (prior to roofing assembly installation).
- B. At Concrete roof deck locations: 10 mil. thick polyethylene vapor retarder/air barrier, loose-layed or mechanically fastened as recommended by manufacturer for removal in the future.

2.6 WALKWAYS

- A. Flexible Walkways: Factory formed, nonporous, heavy duty, solid rubber, slip resisting, aggressive surface textured walkway pads, heat welded to membrane per manufacturers requirements 3/8 to 1/2 inch thickness, and acceptable to membrane roofing system manufacturer.
 - 1. Color: White/Gray, trimmed in safety yellow.
 - 2. Size: 39 inches wide in continuous rolls. Manufacture walkway to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 - 3. Product equal to 96 mils thick, 39" wide, 50' long.
 - 4. Provide 10 rolls of walkway or 500 lin. ft. at locations indicated in the field by owner or architect.

2.7 COVER BOARD

- A. Install the following over roofing insulation: Dens-Deck Prime Roof Board by G-P Gypsum, 1/2" thick, or one of the following comparable products:
 - 1. Securock glass fiber by USG, 1/2" thick
 - 2. HD ISO by JM, 1/2" thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
 - 1. Verify that roof openings and penetrations are in place and set and braced and that roof drains are securely clamped in place.
 - 2. Verify that pressure treated wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 - 3. Verify that surface plane flatness and fastening of steel roof deck comply with requirements in Division 5 Section "Steel Deck."
 - 4. Verify that membrane shows no signs of abrasion, discoloration, or defects.
 - 5. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Prior to installation of any component of the roofing assembly, consult manufacturer's photovoltaic (PV) installation and warranty policy. Follow all technical requirements needed for a fully warranted roof system.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof drain plugs when no work is taking place or when rain is forecast.
- C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- D. Employ roofer for repairing existing roof membrane as approved by the manufacturer, where warranties are still in effect for the existing assembly.

3.3 AIR/VAPOR BARRIER INSTALLATION

- A. Loose-lay the 10 mil air/vapor barrier over acceptable substrate. Overlap all edges 4" and seal with butyl tape. Extend air barrier to perimeter and deck penetrations and seal to provide continuity of the building's air/vapor envelope. Air/vapor barrier must be sealed on the vertical surface at roof penetrations also.
- B. Install self-adhered vapor barrier in place and complete end and side laps per manufacturer's published requirements. Extend air barrier to perimeter and deck penetrations and seal to provide continuity of the building's air/vapor envelope. Air/vapor barrier must be sealed on the vertical surface at roof penetrations also.

3.4 INSULATION INSTALLATION

- A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

- B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
- C. Install tapered insulation between layers of roofing insulation to conform to slopes indicated.
- D. Install two layers of insulation mechanically fastened and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board type roof insulation to deck type.
 - 1. Fasten insulation according to requirements in FMG's "Approval Guide" for specified Windstorm Resistance Classification.
 - 2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.
- E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.
- F. Field trim factory formed units where required to provide slopes in crickets and drains.
- G. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - 1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

3.5 MECHANICALLY ATTACHED ROOFING MEMBRANE INSTALLATION

- A. Install roofing membrane over areas to receive roofing according to roofing system manufacturer's written instructions.
 - 1. Install sheet according to ASTM D 5082.
- B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.
- C. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity.
 - 2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
 - 3. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring. Add second ply where drains are set after membrane installation.
- H. In-Splice Attachment: Secure one edge of roofing membrane using fastening plates or metal battens centered within membrane splice and mechanically fasten roofing membrane to roof deck. Field-splice seam.

- I. Install roofing membrane and auxiliary materials extending over parapet and exterior face of wall a minimum of 2 inches. Ref Details on drawings.

3.6 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates REGARDLESS OF HEIGHT according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.
- F. Extend membrane or transition flashing compatible with air barrier and roof membranes as required to overlap air barrier application for a continuous barrier installation.

3.7 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products in locations indicated, from hatches to roof-top mounted equipment. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. In progress Inspections: Owner will require a qualified manufacturer's technical representative to perform tests and inspections with a weekly inspection during period of installation and a final inspection upon completion. Written inspection reports are to be provided to the owner.
- B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
 1. Notify Architect or Owner 48 hours in advance of date and time of inspection.
- C. Repair or remove and replace components of membrane roofing system where test results or inspections indicate that they do not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.
- C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5419

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sheet metal flashing and trim:
 - 1. Manufactured through-wall flashing
 - 2. Manufactured reglets.
 - 3. Formed low-slope roof flashing and trim.
 - 4. Formed wall sheet metal fabrications
 - 5. Formed equipment support flashing.

1.3 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
 - 1. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft.: 60-lbf/sq. ft. perimeter uplift force, 90-lbf/sq. ft. corner uplift force, and 30-lbf/sq. ft. outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
 - 1. Identify material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
 3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
 4. Details of expansion-joint covers, including showing direction of expansion and contraction.
- C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

1.5 QUALITY ASSURANCE

- A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.
- B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

- A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 SHEET METALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, mill phosphatized for field painting where indicated.

- B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
 - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
 - 2. Exposed Finishes: Apply the following coil coating:
 - a. Metallic Fluoropolymer: AAMA 621. Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 1) Color: As selected by Architect from manufacturer's full range.
- C. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.
- D. Stainless-Steel Sheet: ASTM A 240/A 240M Type 304 dead soft, fully annealed; with smooth, flat surface.

2.3 UNDERLAYMENT MATERIALS

- A. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
 - 1. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
- C. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.
- D. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.
- E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.
- B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

- C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
 - 1. Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- D. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 MANUFACTURED SHEET METAL FLASHING AND TRIM

- A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
 - 1. Manufacturers:
 - a. Cheney Flashing Company, Inc.
 - b. Fry Reglet Corporation.
 - c. Hickman, W. P. Company.
 - d. Keystone Flashing Company, Inc.
 - 2. Material: Galvanized steel, 0.0217 inch thick.
 - 3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

2.7 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fabricate from the following materials:
 - 1. Galvanized Steel: 0.028 inch thick.

2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Copings: Fabricate in minimum 96-inch-long, but not exceeding 10-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
 - 1. Joint Style: Standing seam joint.
 - a. Galvanized Steel: 24 ga.
 - b. Prepainted, Metallic-Coated Steel: 24 ga.
- B. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials. Shop fabricate interior and exterior corners.
 - 1. Galvanized Steel: 0.034 inch thick.

- C. Base Flashing: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch thick.
- D. Counterflashing: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0217 inch thick.
- E. Flashing Receivers: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0217 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following material:
 - 1. Lead: 4.0 lb/sq. ft., hard tempered.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following material:
 - 1. Galvanized Steel: 0.0276 inch thick.

2.10 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing (Drip plates): Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, at bottom of veneers and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch thick.
- B. Opening Flashings in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.016 inch thick.

2.11 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Torch cutting of sheet metal flashing and trim is not permitted.
- B. 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.
 - 1. Coat side of lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
 - 2. 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.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.
- C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
- D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.
- E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
 - 1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
- F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.
- G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
 - 1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
- H. Seal joints with elastomeric sealant as required for watertight construction.

- I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Prein edges of sheets to be soldered to a width of 1-1/2 inches except where pretinned surface would show in finished Work.
 - 1. Do not solder prepainted sheet.

3.3 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.
- B. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
 - 1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 16-inch centers.
 - 2. Anchor interior leg of coping with screw fasteners and washers at 18-inch centers.
- C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.
- D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
 - 1. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.
- E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
 - 1. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
- B. Through-Wall Flashing: Installation of manufactured through-wall flashing is specified in Division 4 Section "Unit Masonry Assemblies."

3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof hatches.

1.3 SUBMITTALS

- A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for roof accessories. Show layouts of roof accessories including plans and elevations. Indicate dimensions, weights, loadings, required clearances, method of field assembly, and components. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

- A. Sheet Metal Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" details for fabrication of units, including flanges and cap flashing to coordinate with type of roofing indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify required openings for each type of roof accessory by field measurements before fabrication and indicate measurements on Shop Drawings.

1.7 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers listed in other Part 2 articles.

2.2 ROOF HATCHES

- A. Roof Hatches: Fabricate roof hatches with insulated double-wall lids and curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
1. Manufacturers:
 - a. Babcock-Davis; a Cierra Products Inc. Company.
 - b. Bilco Company (The).
 - c. Dur-Red Products.
 - d. J. L. Industries, Inc.
 - e. Metallic Products Corporation.
 - f. Milcor Inc.; a Gibraltar Company.
 - g. Roof Products & Systems Corporation.
 - h. Elmdor.
 - i. Precision Ladders, LLC
 2. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
 3. Type and Size: Single-leaf lid, 48 by 48 inches.
 4. Curb and Lid Material: Aluminum-zinc alloy-coated steel sheet, 0.079 inch thick.
 5. Interior Lid Liner: Manufacturer's standard metal liner of same material and finish as outer metal lid.
 6. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
 7. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.
 8. Safety Railing System: Manufacturer's standard complete system including rails, clamps, fasteners, safety barrier at railing opening, and all accessories required for a complete installation.
 - a. Height: 42 inches above finished roof deck.
 - b. Pipe or Tube: 1-1/4-inch ID galvanized pipe or 1-5/8-inch OD galvanized tube.
 - c. Fabricate joints that will be exposed to weather in a watertight manner.
 - d. Close exposed ends of handrail and railing members with prefabricated end fittings.
 - e. Fasteners: Manufacturer's standard.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored and is ready to receive roof accessories.
 2. Verify dimensions of roof openings for roof accessories.
 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions. Anchor roof accessories securely in place and capable of resisting forces specified. Use fasteners, separators, sealants, and other miscellaneous items as required for completing roof accessory installation. Install roof accessories to resist exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Install roof accessories to fit substrates and to result in watertight performance.

- C. 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 manufacturer.
- D. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
- E. Roof Hatch Installation:
 - 1. Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.
 - 2. Attach safety railing system to roof hatch curb.

3.3 CLEANING

- A. Clean exposed surfaces according to manufacturer's written instructions.

END OF SECTION 07 7200

SECTION 07 8413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

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

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - 1. A/D Fire Protection Systems Inc.
 - 2. Grace Construction Products.
 - 3. Hilti, Inc.
 - 4. Johns Manville.
 - 5. Nelson Firestop Products.
 - 6. NUCO Inc.
 - 7. Passive Fire Protection Partners.
 - 8. RectorSeal Corporation.
 - 9. Specified Technologies Inc.
 - 10. 3M Fire Protection Products.
 - 11. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 12. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).

- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
- D. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers 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."
- H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. 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, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

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

3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

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

END OF SECTION 07 8413

SECTION 07 9200 - JOINT SEALANTS

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 sealants for the following applications, including those specified by reference to this Section:
 - 1. Exterior joints in the following surfaces and nontraffic horizontal surfaces:
 - a. Perimeter joints between dissimilar materials and frames of doors and windows.
 - b. Other joints as indicated.
 - 2. Exterior joints in the following horizontal traffic surfaces:
 - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
 - b. Other joints as indicated.
 - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
 - a. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - d. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

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

2.3 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

2.4 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant: Two-component, self-leveling, polyurethane-based elastomeric sealant. ASTM C-920, Type M, Grade P, Class 25, use T, NT, M, G, A, O, I. Federal Specification TT-S-00227E, Type 1, Class A.

2.5 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
 - 1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.6 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin, Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
 - a. Concrete.
 - b. Masonry.

- c. Unglazed surfaces of ceramic tile.
- 3. Remove laitance and form-release agents from concrete.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 JOINT-SEALANT SCHEDULE

- A. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints between metal panels.
 - f. Joints between different materials listed above.
 - g. Perimeter joints between materials listed above and frames of doors, windows and louvers.
 - h. Control and expansion joints in ceilings and other overhead surfaces.
 - i. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Silicone.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Interior joints in vertical surfaces and horizontal nontraffic surfaces:
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry, concrete, walls, and, partitions.
 - d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
 - e. Other joints as indicated on Drawings.
 - 2. Joint Sealant: Elastomeric
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

3.7 ACOUSTICAL JOINT-SEALANT SCHEDULE

- A. Acoustical Sealant for Exposed and Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
 - 1. Products: Provide one of the following:
 - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
 - b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
- B. Acoustical Sealant for Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
 - 1. Products: Provide one of the following:

- a. Pro-Series SC-170 Rubber Base Sound Sealant; Ohio Sealants, Inc.
- b. BA-98; Pecora Corporation.
- c. Tremco Acoustical Sealant; Tremco.

END OF SECTION 07 9200

SECTION 08 1113 – HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior hollow metal door frames with hinge reinforcement
 - 2. Interior hollow metal window frames.
 - 3. Interior sidelight frames
 - 4. Fire-rated door and frame assemblies.
 - 5. Exterior hollow metal doors
 - 6. Exterior hollow metal door frames

1.3 DEFINITIONS

- A. Steel Sheet Thicknesses: Thickness dimensions, including those referenced in ANSI A250.8, are minimums as defined in referenced ASTM standards for both uncoated steel sheet and the uncoated base metal of metallic-coated steel sheets.

1.4 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Frame details for each frame type including dimensioned profiles.
 - 3. Details and locations of reinforcement and preparations for hardware.
 - 4. Details of each different wall opening condition.
 - 5. Details of anchorages, accessories, joints, and connections.
 - 6. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.5 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Doors and Frames:
 - a. Amweld Building Products, Inc.
 - b. Benchmark Commercial Doors; a division of General Products Co., Inc.
 - c. Ceco Door Products; a United Dominion Company.
 - d. Curries Company.
 - e. Kewanee Corporation (The).
 - f. Pioneer Industries Inc.
 - g. Republic Builders Products.
 - h. Steelcraft; a division of Ingersoll-Rand.

2.2 MATERIALS

- A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness.

2.3 DOORS

- A. General: Provide doors of sizes, thicknesses, and designs indicated.
- B. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI 250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
- C. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
 - 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames of 0.053-inch- thick steel sheet for:
 - 1. Level 2 steel doors.
 - 2. Wood doors where indicated.
- C. Hinge Reinforcements: High frequency hinge reinforcements are to be installed on all hollow metal frames in this project, as follows:
 - 1. Provide 7 ga. hinge reinforcement, projection welded to the frame at the factory.
 - 2. Form 10 ga. auxiliary hinge reinforcement to match contour of door frame.
 - 3. Arc weld the auxiliary hinge reinforcement to the standard hinge reinforcement and to the frame in 3 locations.
- D. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- E. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
 - 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 (ASTM A 510M) may be used in place of steel sheet.
- F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide assemblies with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
 - 2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard

construction requirements for tested and labeled fire-rated door assemblies except for size.

- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.6 FABRICATION

- A. General: Fabricate steel door and frame units to comply with ANSI A250.8 and to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 0.053-inch-thick, metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from the following material:
 - 1. Cold-rolled steel sheet.
- D. Core Construction: Manufacturer's standard core construction that produces a door complying with SDI standards.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Single-Acting, Door-Edge Profile: Square edge.
- H. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- I. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- J. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.
- K. Frame Construction: Fabricate frames to shape shown.
 - 1. Fabricate frames with mitered or coped and continuously welded corners.
 - 2. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 - 3. Provide welded frames with temporary spreader bars.
- L. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- M. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

- N. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- (0.8-mm-) thick steel sheet.
 - 1. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.
- O. Astragals: As required by NFPA 80 to provide fire ratings indicated.

2.7 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 - 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 - 4. Install fire-rated frames according to NFPA 80.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
 - 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

END OF SECTION 08 1113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer faces.

1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
 - 1. Indicate dimensions and locations of cutouts.
 - 2. Indicate fire ratings for fire doors.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
 - 1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
 - 1. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flush Wood Doors:
 - a. Buell Door Company.
 - b. Chappell Door Co.
 - c. Eggers Industries; Architectural Door Division.
 - d. Ideal Wood Products, Inc.
 - e. Mohawk Flush Doors, Inc.
 - f. OshKosh Architectural Door Company
 - g. VT Industries Inc.
 - h. Weyerhaeuser Company.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Doors for Transparent Finish:
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species and Cut: Maple, plain sliced.
 - 3. Match between Veneer Leaves: Book.

2.3 SOLID-CORE DOORS

- A. Particleboard Cores: Comply with the following requirements:
 - 1. Particleboard: ANSI A208.1, Grade LD-1.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
- B. Interior Veneer-Faced Doors:
 - 1. Core: Particleboard.
 - 2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- C. Fire-Rated Doors:
 - 1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 - 2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
 - a. 5-inch top-rail blocking.

3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

2.4 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flush rectangular beads.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.5 FABRICATION

- A. Fabricate doors in sizes indicated for Project-site fitting.
 1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 1. Light Openings: Trim openings with moldings of material and profile indicated.

2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards"
 3. Finish: WDMA TR-4 conversion varnish.
 4. Staining: As selected by Architect from manufacturer's full range.
 5. Sheen: Satin

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
 - 1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.
 - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold.
 - a. Comply with NFPA 80 for fire-rated doors.
 - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
 - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

3.3 ADJUSTING

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

END OF SECTION 081416

SECTION 08 3113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Access doors and frames for walls and ceilings.

1.3 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches (75 by 125 mm) in size, in specified finish.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

1.5 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and provide access doors at these locations, whether indicated in the plans or not.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Concealed Flanges
 - 1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Acudor Products, Inc.

- b. Babcock-Davis
 - c. Cendrex Inc.
 - d. Elmdor Morris Group International, Inc.
 - e. J. L. Industries, Inc.
 - f. Karp Associates, Inc.
 - g. Larsen's Manufacturing Company.
 - h. MIFAB, Inc.
 - i. Milcor; Hart & Cooley, Inc.
 - j. Nystrom, Inc.
 - k. Williams Bros. Corporation of America (The).
- 2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: <Insert door size>.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, finished.
 - 6. Frame Material: Same material and thickness as door.
 - 7. Latch and Lock: Cam latch, screwdriver operated.

2.2 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
- C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
 - 3. Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm). Prepare, treat, and coat metal to comply with resin manufacturer's written instructions.
 - a. Color to match color of wall or ceiling surface.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces.

3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 08 3113

SECTION 08 33 00 – Rolling Counter Doors

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes: Electric operated rolling counter doors.
- B. Related Sections:
 - 1. 055000 - Metal Fabrications. Door opening jamb and head members.
 - 2. 061000 - Rough Carpentry. Door opening jamb and head members.
 - 3. 083100 - Access Doors and Panels. Access doors.
 - 4. 087000 - Hardware. Padlocks. Master keyed cylinder.
 - 5. 099100 - Painting. Field painting.
 - 6. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.
- C. Products That May Be Supplied, But Are Not Installed Under This Section:
 - 1. Control Station

1.2 SUBMITTALS

- A. Reference Section 013300 Submittal Procedures; submit the following items:
 - 1. Product Data.
 - 2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
 - 3. Quality Assurance/Control Submittals:
 - a. Provide proof of manufacturer ISO 9001:2008 registration.
 - b. Provide proof of manufacturer and installer qualifications - see 1.3 below.
 - c. Provide manufacturer's installation instructions.
 - 4. Closeout Submittals:
 - a. Operation and Maintenance Manual.
 - b. Certificate stating that installed materials comply with this specification.

1.3 QUALITY ASSURANCE

- A. Qualifications:

1. Manufacturer Qualifications: ISO 9001:2008 registered and a minimum of five years experience in producing counter doors of the type specified.
2. Installer Qualifications: Manufacturer's approval.

1.4 DELIVERY STORAGE AND HANDLING

- A. Reference Section 016600 Product Storage and Handling Requirements.
- B. Follow manufacturer's instructions.

1.5 WARRANTY

- A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.
- B. Maintenance: Submit for owner's consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturer:
Cornell Iron Works, Inc., or Overhead Door Corp.
- B. Distributor:

ALDER SALES CORPORATION

6676 SOUTH 400 WEST

MURRAY

UT

84107

Phone #: 801.262.9700

Fax #: 801.261.8242

Email Address: MLALDER@ALDERS.COM

PIONEER OVHD DOOR SALES, LLC

3348 SOUTH 1575 WEST STE #1

OGDEN

UT

84401

Phone #: 801.627.3667

Fax #: 801.627.2557

Email Address: PIONEEROVERHEAD@DIGIS.NET

WESTERN INDUSTRIAL DOOR COMPANY

7031 COMMERCE PARK DRIVE

MIDVALE

UT

84047

Phone #: 801.566.3305

Fax #: 801.566.3550

Email Address: PJOHNSON@WESTERNDOORINC.COM

B. Model: ESC10

2.2 MATERIALS

A. Curtain:

1. Slats: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, 0.040 inch aluminum with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.
2. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats.
3. Slat Finish:
 - a. Aluminum: Clear anodized.
4. Bottom Bar Finish:
 - a. Aluminum Bar: Clear anodized.

B. Guides:

1. Aluminum: Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.
2. Finish:
 - a. Aluminum Guide: Clear anodized.

C. Counterbalance Shaft Assembly:

1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

D. Brackets: Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures.

1. Finish:
 - a. Phosphate treatment followed by a [light gray] [tan] baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

E. Hood: 0.040 inch (1.016 mm) aluminum with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

1. Finish:
 - a. Aluminum: Clear anodized.

2.3 ACCESSORIES

2.4 OPERATION

- A. Supply Cornell Model MG Electric Motor Operator, industrial duty - rated for a maximum of 20 cycles per hour, cULus listed, Totally Enclosed Non Ventilated gear head operator(s) rated (1/3) (1/2) or (3/4) hp as recommended by door manufacture for size and type of door, 120 Volts, 1 Phase. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, [emergency manual chain hoist] [provisions for auxiliary push-up operation] and control station(s). Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with [an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist.] [a disconnect cable for auxiliary push-up operation.] Operator drive and door driven sprockets shall be provided with #50 roller chain. [Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided.] Operator shall be capable of driving the door at a speed of 6 to 9 inches per second (15 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.
 1. Control Station: Flush mounted, "Open/Close" **key switch** with "Stop" push button; NEMA 1B. Location of key switch per owner.
- B. Provide operator to function with constant pressure close operation to meet UL325-2010 listing standard requirements
- C. Tube Motor Operation: Provide the following device to enable momentary contact close operation.
 1. Provide a 2-wire electric sensing/weather edge seal extending full width of door bottom bar. Contact before door fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a [retracting safety cord and reel] [self-coiling cable] connection to control circuit.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.
- B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.
- C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

- A. General: Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports.
- B. In-wall aluminum post (Approximate size 3 inches x 3 inches x 1/4 inch thick) to support door to be provided and installed by door manufacturer.
- C. Follow manufacturer's installation instructions.

3.3 ADJUSTING

- A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.4 CLEANING

- A. Clean surfaces soiled by work as recommended by manufacturer.
- B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

- A. Demonstrate proper operation to Owner's Representative.
- B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 083323 - OVERHEAD COILING DOORS

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 types of overhead coiling doors:
 - 1. Insulated service door at Exterior Storage Building
 - 2. Interior doors at entrance to Serving 1064
 - 3. Counter door at Cleaning 1066

1.3 DEFINITIONS

- A. Operation Cycle: One complete cycle of a door begins with the door in the closed position. The door is then moved to the open position and back to the closed position.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide overhead coiling doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
 - 1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 - 2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.
 - a. Level of Protection: Basic Protection.
- B. Operation-Cycle Requirements: Provide overhead coiling door components and operators capable of operating for not less than 10,000 cycles.

1.5 SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
 - 1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
 - 2. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.
- B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
 - 1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the overhead coiling door manufacturer for both installation and maintenance of units required for this Project.
- B. Source Limitations: Obtain overhead coiling doors through one source from a single manufacturer.
 - 1. Obtain operators and controls from the overhead coiling door manufacturer.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Alpine Overhead Doors, Inc.
 - 2. The Cookson Company.
 - 3. Overhead Door Corporation.
 - 4. Roll-Lite Door Corp.; Div. of Clopay Building Products Co.
 - 5. Wayne-Dalton Corp.

2.2 INSULATED DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
- B. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested according to ASTM E 283 or DASMA 105.
- C. Curtain R-Value: 4.5 deg F x h x sq. ft./Btu.
- D. Door Curtain Material: Aluminum.
- E. Door Curtain Slats: Flat profile slats of 1-7/8-inch center-to-center height.
 - 1. Insulated-Slat Interior Facing: Metal.
 - 2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch fabricated from aluminum extrusions and finished to match door.

- G. Curtain Jamb Guides: Aluminum or steel with exposed finish matching curtain slats.
- H. Hood: Match curtain material and finish
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
- I. Locking Devices: Equip door with locking device assembly.
 - 1. Locking Device Assembly: Single-jamb side locking bars, operable from inside and outside with cylinders.
- J. Electric Door Operator:
 - 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 2. Operator Location: Wall.
 - 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
 - 4. Motor Exposure: Interior.
 - 5. Emergency Manual Operation: Push-up type.
 - 6. Obstruction-Detection Device: Manufacturer's standard, automatic type.
 - 7. Control Station(s): At projects where a separate man-door is provided to exit the space: provide standard push button on interior. At projects where there is not a separate man-door to exit the space: provide exterior-rated key switch.
- K. Curtain Accessories: Equip door with weatherseals and automatic-closing device.
- L. Door Finish:
 - 1. Aluminum Finish: Clear anodized.
 - 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 INTERIOR DOOR ASSEMBLY

- A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats. Unless otherwise indicated, provide slats of material thickness recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Aluminum Door Curtain Slats: ASTM B 209 or ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
 - a. Aluminum Extrusion Thickness: Not less than 0.051 inch.
 - b. Flat profile slats.
 - 2. Inside Curtain Slat Face: To match material of outside metal curtain slat.
- B. Endlocks for Interior Doors: Manufacturer's standard locks on not less than alternate curtain slats for curtain alignment and resistance against lateral movement.
- C. Bottom Bar for Counter Doors: Manufacturer's standard continuous channel or tubular shape, aluminum extrusions to suit type of curtain slats.
 - 1. Astragal: Provide a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene; for placement between angles or fitted to shape, as a cushion bumper for interior door.

- D. Curtain Jamb Guides for Interior Doors: Fabricate curtain jamb guides of material and finish to match curtain slats, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Provide continuous integral wear strips to prevent metal-to-metal contact and minimize noise of travel and removable stops on guides to prevent overtravel of curtain.

2.4 HOODS AND ACCESSORIES

- A. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weatherseal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
 - 1. Fabricate hoods for aluminum doors, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; 0.032-inch minimum thickness, complying with ASTM B 209.
 - 2. Shape: Round.
- B. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets fitted to bottom and top of exterior doors, unless otherwise indicated. At door head, use 1/8-inch-thick, replaceable, continuous sheet secured to inside of hood.
 - 1. In addition, provide replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene at door jambs for a weathertight installation.
- C. Push/Pull Handles: For push-up-operated on small counter door, provide lifting handles on each side of door.
 - 1. Provide pull-down straps or pole hooks for doors more than 84 inches (2130 mm) high.

2.5 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
 - 1. Lock Cylinders: As specified in Section 087100 "Door Hardware".
 - 2. Keys: Three for each cylinder.
- B. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.6 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of adjustable-tension steel helical torsion spring, mounted around a steel shaft and contained in a spring barrel connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.

- D. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Provide mounting brackets of manufacturer's standard design, either cast-iron or cold-rolled steel plate with bell-mouth guide groove for curtain.

2.7 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. (203 mm/s) and not more than 12 in./sec. (305 mm/s), without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close." Control station must be located to maintain complete visibility of door during operation.
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.

2.8 FINISHES, GENERAL

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

3.2 ADJUSTING

- A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion.

3.3 DEMONSTRATION

- A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Test door closing when activated by detector or alarm connected fire-release system. Reset door-closing mechanism after successful test.
 - 2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, preventive maintenance, and procedures for testing and resetting release devices.
 - 3. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 083323

SECTION 084113 – ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Interior and exterior storefront framing.
 - 2. Interior and exterior manual-swing entrance doors.

1.3 SYSTEM DESCRIPTION

- A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
 - 1. Air infiltration and water penetration exceeding specified limits.
 - 2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
- B. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
 - 1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or 3/4 inch, whichever is smaller, unless otherwise indicated.
 - 2. Static-Pressure Test Performance: Provide entrance and store-front systems that do not evidence material failures, structural distress, failure of operating components to function normally, or permanent deformation of main framing members exceeding 0.2 percent of clear span when tested according to ASTM E 330.
- C. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of 1.57 lbf/sq. ft.

1.4 SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
 - 1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.

- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Submit a written warranty executed by the manufacturer agreeing to repair or replace components of entrance and storefront systems that fail in materials or workmanship within the specified warranty period. Failures include, but are not limited to, the following:
 - 1. Structural failures including, but not limited to, excessive deflection.
 - 2. Adhesive sealant failures.
 - 3. Failure of system to meet performance requirements.
- C. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Arcadia, Inc.
 - 2. Arch Amarlite
 - 3. Commercial Architectural Products, Inc.
 - 4. EFCO Corporation.
 - 5. International Aluminum Corporation; U.S. Aluminum.
 - 6. Kawneer Company, Inc.
 - 7. Tubelite Architectural Systems.
 - 8. Vista wall Architectural Products.
 - 9. Desco
 - 10. Manko Window Systems

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Noise or vibration created by wind and thermal and structural movements.
 - d. Loosening or weakening of fasteners, attachments, and other components.
 - e. Failure of operating units.
- B. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Fixed Glazing and Framing Areas: U-factor for the system of not more than **0.38 Btu/sq. ft. x h x deg F** as determined according to NFRC 100.
 - b. Entrance Doors: U-factor of not more than **0.77 Btu/sq. ft. x h x deg F** as determined according to NFRC 100.
 - c. Venting Windows: Whole window U-factor of not more than **0.45 Btu/sq. ft. x h x deg F** as determined according to NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Fixed Glazing and Framing Areas: SHGC for the system of not more than **0.38** as determined according to NFRC 200.
 - b. Entrance Doors: SHGC of not more than **0.38** as determined according to NFRC 200.
 - c. Venting Windows: Whole window SHGC of not more than **0.38** as determined according to NFRC 200.
 3. Air Leakage:
 - a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than **0.06 cfm/sq. ft.** when tested according to ASTM E283.
 - b. Swinging Doors: Air leakage for the system of not more than **1.00 cfm/sq. ft.** when tested according to ASTM E283.

2.3 STOREFRONT SYSTEMS

- A. Drawings and details are based on Kawneer **Trifab VG 601T**, Front-plane glazed exterior, Center glazed interior, THERMAL framing system. Overall U-factor value for system shall be 0.38 or better, with center-of-glass values designated in section 088000.
- B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
 2. Interior Vestibule Framing Construction: Nonthermal.
 3. Glazing System: Retained mechanically with gaskets on four sides and retained mechanically with gaskets on two sides and structural sealant on two sides.
 4. Glazing Plane: Center.
 5. Finish: Clear anodic finish.
 6. Fabrication Method: Field-fabricated stick system.
 7. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 8. Steel Reinforcement: As required by manufacturer.
- C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Insulated Spandrel Panels: If spandrel units are shown in the drawings as aluminum (opaque) units, provide laminated, metal-faced flat panels with no deviations in plane exceeding 0.8 percent of panel dimension in width or length.
1. Overall Panel Thickness: 1 inch, sandwich panel
 2. Exterior Skin: Aluminum matching storefront framing.
 3. Interior Skin: Aluminum matching storefront framing.
 4. Thermal Insulation Core: Manufacturer's standard rigid, closed-cell, polyisocyanurate board.
 5. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.
- F. Insulating Glass Spandrel Units: As specified in Section 088000 "Glazing".
- G. Venting Windows: As specified in Section 085113 "Aluminum Windows".

2.4 ENTRANCE DOOR SYSTEMS

- A. Drawings and details are based on Kawneer 500 Tuffline.
- B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: 2-inch overall thickness, with minimum 3/16 inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: Wide stile; 5-inch nominal width
 3. Glazing Stops and Gaskets: Beveled snap-on, extruded-aluminum stops and preformed gaskets.
 - a. Provide nonremovable glazing stops on outside of door.

2.5 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 - 1. Sheet and Plate: ASTM B 209.
 - 2. Extruded Bars, Rods, Shapes, and Tubes: ASTM B 221.
- B. Glazing as specified in Division 8 Section "Glazing."
- C. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- D. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- E. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."

2.6 COMPONENTS

- A. Doors: Provide manufacturer's standard 2-inch-thick glazed doors with minimum 3/16-inch-thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
 - 1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
 - 2. Stile Design: Stile; 5-inch nominal width.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Reinforce members as required to retain fastener threads.
 - 2. Do not use exposed fasteners, except for hardware application. For hardware application, use countersunk Phillips flat-head machine screws finished to match framing members or hardware being fastened, unless otherwise indicated.
- C. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:
 - 1. Sliding Weather Stripping: Wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing complying with AAMA 701 requirements.

2.7 HARDWARE

- A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.
- B. Sub-Contractor under this section shall provide all the door hardware for all Aluminum Doors. See Door Schedule on drawings and Section 8710 Door Hardware for aluminum doors locations and the required hardware.

2.8 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- F. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- G. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.
 - 2. Interior Doors: Provide ANSI/BHMA A156.16 silencers at stops to prevent metal to metal contact. Provide 3 silencers on strike jamb of single-door frames and 2 silencers on head of double-door frames.

2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."
- E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
 - 1. Install surface-mounted hardware according to manufacturer's written instructions using concealed fasteners to greatest extent possible.
- G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.

3.3 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.4 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Mechanical and electrified door hardware
2. Electronic access control system components

B. Section excludes:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
2. Division 06 Section "Rough Carpentry"
3. Division 06 Section "Finish Carpentry"
4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - c. "Stile and Rail Wood Doors"
 - d. "Interior Aluminum Doors and Frames"
 - e. "Aluminum-Framed Entrances and Storefronts"
 - f. "Stainless Steel Doors and Frames"
 - g. "Special Function Doors"
 - h. "Entrances"
6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC

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. Keying Systems and Nomenclature
4. Installation Guide for Doors and Hardware

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electric Code
2. NFPA 80 – 2016 Edition – Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 – Life Safety Code
4. NFPA 105 – Smoke and Draft Control Door Assemblies
5. NFPA 252 – Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute

1. ANSI A117.1 – 2017 Edition – Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
 - a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:

1. Product Data: Submit 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. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
3. Door Hardware Schedule:
 - a. Submit 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 critical in Project construction schedule.

- b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
 - c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
4. Key Schedule:
- a. After Keying Conference, provide keying schedule that includes levels of keying, explanations 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. 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.
- C. Informational Submittals:
- 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- 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. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
3. Architectural Hardware Consultant: 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:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Pre-Installation Meetings

1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- 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. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. 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.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

1.06 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. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Falcon W
 - b) Falcon T
 - 2) Exit Devices
 - a) Falcon 24/25
 - 3) Closers
 - a) Falcon SC70/80

1.08 MAINTENANCE

- A. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
 - 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.
- C. 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.
- D. 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. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed 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 wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- 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.
- C. Cable and Connectors:

1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide hinges conforming to ANSI/BHMA A156.1.
2. Provide five knuckle, ball bearing hinges.
3. 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
4. 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
5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
7. 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.
8. 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. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 ELECTRIC POWER TRANSFER

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin EPT-10
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.05 PIVOT SETS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide pivot sets complete with oil-impregnated top pivot, unless indicated otherwise.
2. Where offset pivots are specified, Provide one intermediate pivot for doors less than 91 inches (2311 mm) high and one additional intermediate pivot per leaf for each additional 30 inches (762 mm) in height or fraction thereof. Intermediate pivots spaced equally not less than 25 inches (635 mm) or not more than 35 inches (889 mm) on center, for doors over 121 inches (3073 mm) high.
3. Provide appropriate model where pivot sets are scheduled at fire rated openings.
4. Provide pivots with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electrified pivot nearest to electrified locking component. If manufacturer of electrified locking component requires another device for power transfer, then provide recommended power transfer device and appropriate quantity of pivots.
5. Provide mortar guard for each electric pivot specified, unless specified in hollow metal frame specification.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

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. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
 - a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
 - b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
 - e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
3. Cylinders: Refer to "KEYING" article, herein.
4. 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.
5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
8. Provide electrified options as scheduled in the hardware sets.
9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: Rhodes

2.08 CYLINDRICAL LOCKS – GRADE 1

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon T series

2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

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, herein.
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: Dane

2.09 CYLINDRICAL LOCKS – GRADE 2

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon W series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 2, and UL Listed for 3-hour fire doors.
2. Cylinders: Refer to "KEYING" article, herein.
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. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design: Dane

2.10 DEADBOLTS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Schlage B600/B700/B800 Series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide grade 1 deadbolt series conforming to ANSI/BHMA A156.
2. Cylinders: Refer to "KEYING" article, herein.
3. Provide deadbolts with standard 2-3/4 inches (70 mm) backset. Provide 2-3/8 inches (60 mm) where noted or if door or frame detail requires. Provide deadbolt with full 1-inch (25 mm) throw, constructed of steel alloy.
4. Provide manufacturer's standard strike.
5. Lock Status Indicator Trim: Where specified, provide escutcheon with lock status indicator window.
 - a. Escutcheon height 4.125 inches, width 2.54 inches. Projection 1.32 inches on thumbturn side and 1.28 inches on cylinder side.
 - b. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
 - c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
 - d. Indicator window to provide 180-degree visibility.

2.11 EXIT DEVICES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon 24/25 series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

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, herein.
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.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.12 ACCESS CONTROL READER

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. By Security Contractor.

2.13 ELECTRIC STRIKES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Von Duprin 6000 Series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide electric strikes designed for use with type of locks shown at each opening.
2. Provide electric strikes UL Listed as burglary resistant that are tested to a minimum endurance test of 1,000,000 cycles.
3. Where required, provide electric strikes UL Listed for fire doors and frames.
4. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.14 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. By Security contractor.

2.15 CYLINDERS

A. Manufacturers:

1. Scheduled Manufacturer and Product:
 - a. Best SFIC
2. Acceptable Manufacturers and Products:
 - a. Falcon SFIC

B. Requirements:

1. Provide cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.16 KEYING

- ### A. Scheduled System: To be verified with owner.

1. New factory registered system:
 - a. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
 2. Existing factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.
 3. Existing non-factory registered system:
 - a. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:
 - 1) Firm Name:
 - 2) Contact Person:
 - 3) Telephone:
- B. Requirements:
1. Construction Keying:
 - a. Temporary Construction Cylinder Keying.
 - 1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
 - a) Split Key or Lost Ball Construction Keying System.
 - b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
 - c) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will void operation of temporary construction keys.
 - b. Replaceable Construction Cores.
 - 1) Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
 - a) 3 construction control keys
 - b) 12 construction change (day) keys.
 - 2) Owner or Owner's Representative will replace temporary construction cores with permanent cores.
 2. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward bitting 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.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - 3) Geographically Exclusive: Where High Security or Security cylinders/cores are indicated, provide nationwide, geographically exclusive key system complying with the following restrictions.
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.

- 3) 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" along with the "PATENTED" or patent number to enforce the patent protection.
- 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
- 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
- e. Quantity: Furnish in the following quantities.
 - 1) Permanent Control Keys: 3.
 - 2) Master Keys: 6.
 - 3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
 - 4) Key Blanks: Quantity as determined in the keying meeting.

2.17 KEY CONTROL SYSTEM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Telkee
2. Acceptable Manufacturers:
 - a. HPC
 - b. 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.

2.18 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon SC70A series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum cylinder.
3. Closer Body: 1-1/2-inch (38 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.

2.19 DOOR CLOSERS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product:
 - a. Falcon SC80A series
2. Acceptable Manufacturers and Products:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with aluminum 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.

2.20 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.21 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide protection plates with a 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 plates 2 inches (51 mm) less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch (25 mm) less width of door on pairs without a mullion or edge guards.
3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.22 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers:
 - a. Glynn-Johnson
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.23 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
2. Where a wall stop cannot be used, provide universal floor stops.
3. Where wall or floor stop cannot be used, provide overhead stop.
4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.24 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Zero International
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide thresholds, weather-stripping, and gasketing systems 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. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.25 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

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.

2.26 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Schlage
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.

2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.27 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer:
 - a. Ives
2. Acceptable Manufacturers:
 - a. Substitute by Architect approval.

B. Provide coat hooks as specified.

2.28 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

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. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

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. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.
- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Lock Cylinders:
1. Install construction cores to secure building and areas during construction period.
 2. Replace construction cores with permanent cores as indicated in keying section.
 3. Furnish permanent cores to Owner for installation.
- J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY 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. Connections to panel interface modules, controllers, and gateways.
 6. 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.
- L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.
- M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

- N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- O. 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.
- P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- Q. 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.
- R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 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. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. 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, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION



- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

- A. 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. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets:

124656 OPT0401175 Version 1

Legend:







-  Link to catalog cut sheet
-  Electrified Opening

Hardware Group No. 01

For use on Door #(s):

A104A A115A A122A

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	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SURFACE CLOSER	SC81A REG		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE





VERIFY WALL STOPS ACCEPTABLE.

Hardware Group No. 02

For use on Door #(s):

A105A A106A

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	ENTRY / OFFICE LOCK	W511H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 03

For use on Door #(s):

A112A A113A A114A A130A A131A A132A

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	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SURFACE CLOSER	SC81A HW/PA		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 04

For use on Door #(s):

A129A A135A

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	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	OH STOP	90S		689	GLY
1	EA	SURFACE CLOSER	SC81A HW/PA		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 05

For use on Door #(s):

A111A A119A A126A

Provide each SGL door(s) with the following:






QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SURFACE CLOSER	SC81A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 06

For use on Door #(s):

A124A

Provide each SGL door(s) with the following:








QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP		652	IVE
1	EA	STOREROOM LOCK	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SURFACE CLOSER	SC81A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 07

For use on Door #(s):

A109A

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 W/ OUTSIDE INDICATOR	ND40S RHO OS-OCC		626	SCH
1	EA	SURFACE CLOSER	SC81A REG		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
1	EA	COAT AND HAT HOOK	582		626	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 08 - P/P

For use on Door #(s):

A121A A123A

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	PUSH PLATE	8200 6" X 16"		630	IVE
1	EA	PULL PLATE	8305 10" 6" X 16"		630	IVE
1	EA	SURFACE CLOSER	SC81A HDPA		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/407CCV		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 09

For use on Door #(s):

A135C

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 CON		✂ 689	VON
1	EA	ELEC PANIC HARDWARE	RX-MEL-25-R-NL-CON 24 VDC		✂ 626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	SURFACE CLOSER	SC71A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
2	EA	WIRE HARNESS	CON-XX AS REQUIRED		✂	SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR		✂ BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED		✂ 628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		✂ LGR	SCE

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. 10

For use on Door #(s):
A136A









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	25-R-NL		626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	SURFACE CLOSER	SC71A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	 ✎	628	SCE

Hardware Group No. 11

For use on Door #(s):
A101A

Provide each PR door(s) with the following:











QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	PIVOT SET	7226 SET		626	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
2	EA	MANUAL FLUSH BOLT	FB458		US26D	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED		626	IVE
1	EA	STOREROOM LOCK	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SURFACE CLOSER	SC81A HW/PA		689	FAL
1	EA	MOUNTING PLATE	SC80A-18		689	FAL
2	EA	WALL STOP	WS406/WS407 CCV/CVX AS REQUIRED		630	IVE
1	EA	WEATHERSTRIP/CONTA CT SEAL	BY DOOR MANUFACTURE			

A101A- VERIFY SUFFICIENT CLEARANCE BEHIND DOOR FOR MOUNTING OF DOOR CLOSER
PULLSIDE.

Hardware Group No. 12

For use on Door #(s):
A120A

Provide each SGL door(s) with the following:







QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	 ✎	652	IVE
1	EA	STOREROOM LOCK	W581H DAN		626	FAL
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	ELECTRIC STRIKE	6211 FSE CON 12/16/24/28 VAC/VDC	 ✎	630	VON
1	EA	SURFACE CLOSER	SC81A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
3	EA	SILENCER	SR64		GRY	IVE
1	EA	WIRE HARNESS	CON-XX AS REQUIRED	✎		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	 ✎	BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	 ✎	628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	 ✎	LGR	SCE

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RELEASES ELECTRIC
STRIKE TO ALLOW ENTRY OR BY KEY.
INSIDE LEVER ALWAYS ALLOWS EGRESS.

Hardware Group No. 13

For use on Door #(s):
A135B






Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	25-R-L-NL-DANE		626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	SURFACE CLOSER	SC81A HDPA		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/WS407 CCV/CVX AS REQUIRED		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

Hardware Group No. 14

For use on Door #(s):
A135E










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	DUMMY PUSH BAR	250DT		626	FAL
1	EA	LONG DOOR PULL	9264F 36"		630-316	IVE
1	EA	SURFACE CLOSER	SC71A HDP		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	FLOOR STOP	FS436/FS438 AS REQUIRED		626	IVE
1	EA	WEATHERSTRIP/CONTACT SEAL	BY DOOR MANUFACTURE			

Hardware Group No. 15

For use on Door #(s):
A202B








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	PASSAGE SET	T101 DAN		626	FAL
1	EA	DBL CYL DEADBOLT W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	B662BD OS-LOC IS-LOC		626	SCH
2	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
2	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	SURFACE CLOSER	SC71A SS		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	RAIN DRIP	142AA		AA	ZER
1	SET	GASKETING	429AA-S		AA	ZER
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER

Hardware Group No. 16

For use on Door #(s):
A202A

Provide each SGL door(s) with the following:
















QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP		652	IVE
1	EA	PANIC HARDWARE	25-R-L-NL-DANE		626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	SFIC CORE	CB847 SFIC		622	FAL
1	EA	SURFACE CLOSER	SC71A HDPA		689	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	WALL STOP	WS406/WS407 CCV/CVX AS REQUIRED		630	IVE
3	EA	SILENCER	SR64		GRY	IVE

SECOND FLOOR TO GET TO ROOF ACCESS ONLY. SECOND FLOOR NOT OCCUPIED AT THIS TIME. AT A LATER DATE IF SECOND FLOOR BECOMES OCCUPIED THIS EXIT DEVICE TRIM WILL NEED REVIEWED.

Hardware Group No. AL01

For use on Door #(s):
A117A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PIVOT SET	7226 SET		626	IVE
1	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
1	EA	POWER TRANSFER	EPT10 CON	 ⚡	689	VON
1	EA	ELEC PANIC HARDWARE	RX-MEL-25-R-NL-OP-CON 24 VDC	 ⚡	626	FAL
1	EA	SFIC RIM HOUSING	AS REQUIRED		626	SCH
1	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
1	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
1	EA	LONG DOOR PULL	9264F 36"		630- 316	IVE
1	EA	SURFACE CLOSER	SC71A HDPA		689	FAL
1	EA	MOUNTING PLATE	SC70A-18PA		689	FAL
1	EA	CUSH SHOE SUPPORT	SC70A-30		689	FAL
1	EA	BLADE STOP SPACER	SC70A-61		689	FAL
1	EA	FLOOR STOP	FS18S		BLK	IVE
1	EA	WEATHERSTRIP/CONTA CT SEAL	BY DOOR MANUFACTURE			
1	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
2	EA	WIRE HARNESS	CON-XX AS REQUIRED	⚡		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	 ⚡	BLK	SCE
1	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	 ⚡	628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	 ⚡	LGR	SCE









DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. AL02

For use on Door #(s):

A103A A133A



















Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	PIVOT SET	7226 SET		626	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
2	EA	DUMMY PUSH BAR	250DT		626	FAL
2	EA	LONG DOOR PULL	9264F 36"		630- 316	IVE
2	EA	SURFACE CLOSER	SC71A HDP		689	FAL
2	EA	MOUNTING PLATE	SC70A-18PA		689	FAL
2	EA	CUSH SHOE SUPPORT	SC70A-30		689	FAL
2	EA	BLADE STOP SPACER	SC70A-61		689	FAL
2	EA	WALL STOP	WS406/WS407 CCV/CVX AS REQUIRED		630	IVE
1	EA	WEATHERSTRIP/CONTACT SEAL	BY DOOR MANUFACTURE			

Hardware Group No. AL03

For use on Door #(s):
A102A

Provide each PR door(s) with the following:









QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	PIVOT SET	7226 SET		626	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-25-R-EO-CON	 ✎	626	FAL
1	EA	ELEC PANIC HARDWARE	RX-MEL-25-R-NL-OP-CON 24 VDC	 ✎	626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC RIM HOUSING	AS REQUIRED		626	SCH
2	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
2	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
2	EA	LONG DOOR PULL	9264F 36"		630- 316	IVE
2	EA	OH STOP	100S ADJ		630	GLY
2	EA	SURFACE CLOSER	SC71A HDPA		689	FAL
2	EA	MOUNTING PLATE	SC70A-18PA		689	FAL
2	EA	CUSH SHOE SUPPORT	SC70A-30		689	FAL
2	EA	BLADE STOP SPACER	SC70A-61		689	FAL
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	WEATHERSTRIP/CONTA CT SEAL	BY DOOR MANUFACTURE			
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
4	EA	WIRE HARNESS	CON-XX AS REQUIRED	✎		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	 ✎	BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	 ✎	628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	 ✎	LGR	SCE

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER TO ALLOW ADA PUSH BUTTON TO
ACTIVATE AUTO OPERATOR AND OPEN DOOR INSIDE ADA PUSH BUTTON ALWAYS ACTIVE.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

Hardware Group No. AL04

For use on Door #(s):
A116A



















Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	PIVOT SET	7226 SET		626	IVE
1	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
1	EA	DUMMY PUSH BAR	250DT		626	FAL
1	EA	LONG DOOR PULL	9264F 36"		630- 316	IVE
1	EA	SURFACE CLOSER	SC71A HDP		689	FAL
1	EA	MOUNTING PLATE	SC70A-18PA		689	FAL
1	EA	CUSH SHOE SUPPORT	SC70A-30		689	FAL
1	EA	BLADE STOP SPACER	SC70A-61		689	FAL
1	EA	WALL STOP	WS406/WS407 CCV/CVX AS REQUIRED		630	IVE
1	EA	WEATHERSTRIP/CONTACT SEAL	BY DOOR MANUFACTURE			

Hardware Group No. AL05

For use on Door #(s):
A134A

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
2	EA	PIVOT SET	7226 SET		626	IVE
2	EA	INTERMEDIATE PIVOT	7226 INT		626	IVE
2	EA	POWER TRANSFER	EPT10 CON	 ✎	689	VON
1	EA	REMOVABLE MULLION	KR4954 STAB		689	VON
1	EA	ELEC PANIC HARDWARE	RX-25-R-EO-CON	 ✎	626	FAL
1	EA	ELEC PANIC HARDWARE	RX-MEL-25-R-NL-OP-CON 24 VDC	 ✎	626	FAL
1	EA	SFIC MORTISE CYL.	AS REQUIRED		626	SCH
1	EA	SFIC RIM HOUSING	AS REQUIRED		626	SCH
2	EA	SFIC CORE	BEST SMALL B KEYWAY FORMAT - 7 PIN		626	BES
2	EA	SFIC CONSTRUCTION CORE	AS REQUIRED		622	
2	EA	LONG DOOR PULL	9264F 36"		630- 316	IVE
2	EA	SURFACE CLOSER	SC71A HDP		689	FAL
2	EA	MOUNTING PLATE	SC70A-18PA		689	FAL
2	EA	CUSH SHOE SUPPORT	SC70A-30		689	FAL
2	EA	BLADE STOP SPACER	SC70A-61		689	FAL
2	EA	FLOOR STOP	FS18S		BLK	IVE
2	EA	MULLION SEAL	8780NBK PSA		BK	ZER
1	EA	WEATHERSTRIP/CONTA CT SEAL	BY DOOR MANUFACTURE			
2	EA	DOOR SWEEP	39A		A	ZER
1	EA	THRESHOLD	VERIFY SILL CONDITION		A	ZER
4	EA	WIRE HARNESS	CON-XX AS REQUIRED	✎		SCH
1	EA	CARD READER	BY SECURITY CONTRACTOR	 ✎	BLK	SCE
2	EA	DOOR CONTACT	7764 / 679-05 AS REQUIRED	 ✎	628	SCE
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	 ✎	LGR	SCE

DOOR IS NORMALLY LOCKED. RESTRICTING ENTRY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER MOMENTARILY RETRACTS LATCH TO
ALLOW ENTRY OR BY KEY.
AUTHORIZED CREDENTIAL AT OUTSIDE CARD READER TO ALLOW ADA PUSH BUTTON TO
ACTIVATE AUTO OPERATOR AND OPEN DOOR INSIDE ADA PUSH BUTTON ALWAYS ACTIVE.
INSIDE TOUCHBAR ALWAYS ALLOWS EGRESS.

MTECH
Cosmetology College

NJRA Architects Project #24715.00
Construction Documents

Hardware Group No. OH01

For use on Door #(s):

A104B A135D

Provide each RU door(s) with the following:

QTY	DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	OVERHEAD DOOR	HARDWARE BY MANUFACTURER		

END OF SECTION

SECTION 088000 - GLAZING

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 glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windows.
 - 2. Doors.
 - 3. Glazed curtain walls.
 - 4. Glazed entrances.
 - 5. Glazed interior guardrails.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- C. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- D. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
 - a. Specified Design Wind Loads: As indicated.
 - b. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 6.5, "Method 2- Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - c. Specified Design Snow Loads: As indicated, but not less than snow loads applicable to Project as required by ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 7.0, "Snow Loads."
 - C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- 1.5 SUBMITTALS
- A. Product Data: For each glass product and glazing material indicated.
 - B. Samples: For the following products, in the form of 12-inch-square samples for glass and of 12-inch-long Samples for sealants. Install sealant samples between two strips of material representative in color of the adjoining framing system.
 1. Insulated glass unit.
 2. Ceramic-coated spandrel glass unit.
 3. Frosted glass unit.
 4. Laminated glass unit.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
 - B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.
- 1.8 PROJECT CONDITIONS
- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 1. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg F.

1.9 WARRANTY

- A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Product: Subject to compliance with requirements, provide product specified.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
 2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 3. Provide Kind FT (fully tempered) designated as tempered, float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Frosted Glass: Acid-etched to obtain an opaque effect.
- D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.
1. Color: Color shall be selected by architect from full range of colors (Grays, Greens, Black, etc.)
- E. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
 2. Provide Kind FT (fully tempered) designated as tempered, glass lites where safety glass is indicated.
 3. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
 4. Sealing System: Dual seal, with primary and secondary sealants as follows:
 - a. Manufacturer's standard sealants.
 5. Spacer Specifications: Manufacturer's standard spacer material and construction.

2.3 GLAZING GASKETS

- A. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.4 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- B. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Single-Component Neutral- and Basic-Curing Silicone Glazing:
 - a. Available Products:
 - 1) GE Silicones; SilPruf SCS2000.
 - 2) Polymeric Systems Inc.; PSI-641.
 - 3) Sonneborn, Div. of ChemRex, Inc.; Omniseal.
 - 4) Tremco; Spectrem 3.
 - b. Type and Grade: S (single component) and NS (non-sag).
 - c. Class: 50.
 - d. Use Related to Exposure: NT (non-traffic).

2.5 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; non-staining and non-migrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.8 MONOLITHIC FLOAT-GLASS UNITS

- A. Uncoated Clear Float-Glass Units: Class 1 (clear) Kind HS (heat-strengthened) float glass, Kind FT (fully tempered) float glass.
 - 1. Thickness: 6.0 mm.
- B. Uncoated Clear Float-Glass Units: Class 1, Kind HS (heat-strengthened), Kind FT (fully tempered) float glass.
 - 1. Basis-of-Design Product: PPG Industries, Inc.
 - 2. Thickness: 6.0 mm.
 - 3. Tint Color: "Clear".

2.9 FROSTED GLASS UNITS

- A. Frosted Glass: Acid-etched to obtain an opaque effect.
 - 1. Basis-of-Design Product: "Solarban 60 Double-IGU" by Vitro (Formerly PPG Industries)
 - 2. Class 1 (clear) float glass.
 - 3. Kind HS (heat strengthened), FT (fully tempered).
 - 4. Thickness: 6.0 mm.
 - 5. Acid-etching Location: Second surface for single pane, third surface for insulating glass.
 - 6. Pattern: As selected by architect from Manufacturer's full range.

2.10 INSULATED GLASS UNITS

- A. Clear Insulating-Glass Units with Low-E coating:
 - 1. Basis-of-Design Product: "Solarban 60 Double-IGU" by Vitro (Formerly PPG Industries)
 - 2. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
 - 3. Interspace Content: Air or Argon gas.
 - 4. Outdoor Lite: Class 1 (clear) float glass.
 - a. Tint Color: "Clear".
 - b. Kind HS (heat strengthened), Kind FT (fully tempered).
 - 5. Indoor Lite: Class 1 (clear) float glass.
 - a. Annealed, Kind HS (heat strengthened), Kind FT (fully tempered).
 - 6. Low-E coating Location: Second surface.
 - 7. Acid-Etching location (as occurs): See above
 - 8. Visible Light Transmittance: 70%
 - 9. SHGC: 0.39

2.11 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
 - 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing glazing, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep system.
 - 3. Minimum required face or edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Do not remove release paper from tape until just before each glazing unit is installed.

3.5 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 088000

SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
- B. Related Requirements:
 - 1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For high-strength steel studs and tracks, firestop tracks, post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite and non-composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft..

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645.
 - 1. Steel Studs and Tracks:
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) Custom Stud.
 - 4) Jaimes Industries.
 - 5) MarinoWARE.
 - 6) MBA Building Supplies.
 - 7) MRI Steel Framing, LLC.
 - 8) Phillips Manufacturing Co.
 - 9) SCAFCO Steel Stud Company.
 - 10) Steel Construction Systems.
 - 11) Telling Industries.
 - 12) The Steel Network, Inc.
 - b. Minimum Base-Steel Thickness: As indicated on Drawings.
 - c. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch minimum vertical movement.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) Fire Trak Corp.
 - 4) MarinoWARE.
 - 5) SCAFCO Steel Stud Company.
 - 6) Steel Construction Systems.
 - 7) Super Stud Building Products Inc.
 - 8) The Steel Network, Inc.
2. Single Long-Leg Track System: ASTM C645 top track with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
4. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Metal-Lite.
 - 6) Perfect Wall, Inc.
 - 7) SCAFCO Steel Stud Company.
 - 8) Steel Construction Systems.
 - 9) Telling Industries.
 - 10) The Steel Network, Inc.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 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. CEMCO; California Expanded Metal Products Co.
 - b. ClarkDietrich.
 - c. Fire Trak Corp.
 - d. MarinoWARE.
 - e. Metal-Lite.
 - f. Perfect Wall, Inc.
 - g. SCAFCO Steel Stud Company.
 - h. Steel Construction Systems.
 - i. The Steel Network, Inc.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.
 - f. Steel Construction Systems.
 - 2. Minimum Base-Steel Thickness: As indicated on Drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
 - 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. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.
 - f. Steel Construction Systems.
 - 2. Depth: 1-1/2 inches.
 - 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 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. ClarkDietrich.
 - b. Jaimes Industries.
 - c. MarinoWARE.
 - d. MBA Building Supplies.

- e. MRI Steel Framing, LLC.
 - f. SCAFCO Steel Stud Company.
 - g. Steel Construction Systems.
- 2. Minimum Base-Steel Thickness: As indicated on Drawings.
- 3. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 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. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.
 - f. Steel Construction Systems.
 - 2. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.
 - f. Steel Construction Systems.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:

1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: Torque-controlled, expansion anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.
 - d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
 2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.
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. Armstrong World Industries, Inc.
 - b. Rockfon (Rockwool International).
 - c. USG Corporation.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
 2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
 3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.

- b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
- 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 16 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 5. Do not attach hangers to steel roof deck.
 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 092220 – ACOUSTICAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide materials, fabrications and installation of acoustical insulation and associated accessories.

1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Manufacturer's product data and literature describing each type of insulation.

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Insulation shall be certified by the manufacturer to comply with California standards for insulating materials.
 - 2. Insulating materials shall be installed in compliance with Flame Spread Rating and Smoke Density requirements of IBC.
- B. Fire Performance Characteristics: Provide insulation materials whose fire performance characteristics have been determined per the ASTM test method indicated below. Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E84
 - 2. Fire Resistance Ratings: ASTM E119
 - 3. Combustion Characteristics: ASTM E136
- C. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver and store packaged materials in original containers bearing identification of manufacturer's name, thermal resistance rating, and fiber materials. Maintain seals unbroken and labels intact until time of use.
- C. Keep materials dry by storing off ground under watertight covers.

1.6 PROJECT CONDITIONS

- A. Comply with requirements of Section 013100 – Project Management and Coordination.
- B. Do not install insulation until construction has progressed to a point that inclement weather will not damage or wet insulation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acoustical Insulation: Unfaced, friction-fit, flexible sound attenuation batt of fiberglass.
 - 1. Provide thermal resistance rating of R-13 for 3-5/8" and 4" stud wall and R-19 for 6" stud walls, unless otherwise shown.
 - 2. Comply with requirements of ASTM C 665-84, Type I.
 - 3. Manufacturers: Owens-Corning Fiberglass Corp. "Unfaced Fiberglass Insulation," Schuller- "Unfaced Fiberglass Insulation" or Certainteed Products Corp. "Rigid Fit Unfaced Fiberglass Insulation."

2.2 ACCESSORIES

- A. Electrical Box Acoustical Sealer: Resilient sealer pads; "Electrical Box Pads" manufactured by 3M, or approved equivalent.
- B. Insulation Support: String wire, staples, nails as required.
- C. Stick Fasteners: Rust-resistant metal fasteners and washers adhesively applied to substrate. Stic-Klip Mfg. Co. "Type A or N" with Speed Washers or Miracle Adhesives Corp. "Stuk-Ups, Prong or Spindle and Washer".
- D. Adhesive for Stick Fasteners: Type as recommended by fastener manufacturer.
- E. Sealing Tape: Type as recommended by the thermal insulation manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive insulation for conditions that will adversely affect installation and performance.
- B. Do not start work until defects have been corrected.
- C. Coordination: Ensure that all work that will be concealed by the work of this Section, such as electrical and plumbing work, that require inspection, have received all required inspections and been accepted by the inspecting authority.

3.2 INSTALLATION OF INSULATION

- A. General Requirements:

1. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
 2. Install insulation to fit snugly between framing members and around pipes, conduits, and outlet boxes as necessary to maintain integrity of insulation.
 3. Provide means to prevent displacement where required.
- B. Acoustical Insulation:
1. Fill spaces between studs with acoustical insulation.
 2. Cover rear surface of all recessed mechanical and electrical outlet boxes with outlet box acoustical isolation pad.

3.3 DEFECTIVE WORK

- A. Remove any wet insulation or material deemed defective by the Architect, and replace with new material.
- B. Restore other work to original condition which was damaged by repair or replacement of defective insulation work.
- C. Remove damaged materials from project.

3.4 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Exterior gypsum board for ceilings and soffits.
 - 3. Tile backing panels.

1.3 ACTION SUBMITTALS

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

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

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

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Thickness: 5/8 inch.
 - 2. Long Edges: Tapered.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.
- B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.

2.5 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
 - 1. Core: 5/8 inch, Type X.
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 3. Install at all ceramic wall tile locations.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
 - 1. Thickness: 5/8 inch.
 - 2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
 - 3. Install at all porcelain wall tile locations.
- C. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

- a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use setting-type, sandable topping compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping.
- D. Joint Compound for Exterior Applications:
- 1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
- E. Joint Compound for Tile Backing Panels:
- 1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
 - 2. Cementitious Backer Units: As recommended by backer unit manufacturer.
 - 3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
- 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
 - 1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 - 2. Fasten with corrosion-resistant screws.

3.4 APPLYING TILE BACKING PANELS

- A. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.
- D. Exterior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. LC-Bead: Use at exposed panel edges.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 5: All exposed locations including walls, soffits, headers, etc.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.
- H. Special Gypsum board finish may be required at specialty light fixtures specified to have "Flangeless" appearance. Coordinate with light fixture schedule and electrician. At these locations. linear light fixtures are recessed into gypsum board. Drywall contractor is required to mud over raw aluminum flange up to the lens of the light fixture. Drywall contractor must coordinate with fixture manufacturer's details for the desired finish.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.8 PARTITION IDENTIFICATION

- A. Identify partitions indicated on drawings as having a required fire or smoke rating.
 - 1. Follow guidelines set in Chapter 7 of International Building Code or as locally amended.
 - 2. Permanently identify with stenciling:
 - a. Minimum 6 inches high letters with minimum ½ inch stroke.
 - b. Bottom of lettering to start at 6 inches above ceiling.
 - c. Stenciling to be 10 feet on center max.
 - d. Color: Red for 1-hr rated walls, Blue for 2-hr rated walls, Green for smoke partition walls.
 - e. Provide in a manner acceptable to authority having jurisdiction.

END OF SECTION 092900

SECTION 093013 – CERAMIC/PORCELAIN TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Quarry floor tile.
 - 2. Ceramic wall tile.
 - 3. Porcelain floor and wall tile.
 - 4. Quartz thresholds installed as part of tile installations.
 - 5. Waterproof membrane
 - 6. Crack isolation membrane.
 - 7. Metal edge strips.

1.3 DEFINITIONS

- A. Facial Dimension: Nominal tile size as defined in ANSI A137.1.
- B. Installation products: ANSI A118
- C. Installation procedures ANSI 108

1.4 SUBMITTALS

- A. Product Data: For each type of tile, mortar, grout, and other products specified.
- B. Shop Drawings: Show locations for each type of tile and tile pattern.
- C. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
 - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.
- B. Store liquid latexes and emulsion adhesives in unopened containers and protected from freezing.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.8 EXTRA MATERIALS

- A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers specified:

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard Grade requirements, unless otherwise indicated.
- B. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide the specific products listed below and on the Finish Schedule or comparable products by another approved manufacturer.

2.3 TILE PRODUCTS

- A. Manufacturers:
 - 1. American Olean; Div. of Dal-Tile International Corp.
 - 2. Dal-Tile; Div. of Dal-Tile International Inc.
 - 3. United States Ceramic Tile Company.
 - 4. Interceramic Tile and Stone Company
 - 5. Bedrosians Tile and Stone
- B. Products:
 - 1. See Finish Schedule located on sheet A603A of the drawings for all tile products including Manufacturer, Style, Size, Color, and Composition.
- C. Glazed Ceramic Wall Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 - 1. Base for Thin-Set Mortar Installations: Coved, module size 4-1/4 by 4-1/4 inches.
 - 2. Wainscot Cap for Thin-Set Installations: Surface bullnose, module size 4-1/4 by 4-1/4 inches (matching wall tile).
 - 3. External Corners for Thin-Set Installations: Surface bullnose.

4. Internal Corners for Thin-Set Installations: Field-buttet square corners except with coved base and cap angle pieces designed to fit with stretcher shapes.
- D. Accessories for Glazed Wall Tile: Provide vitreous china accessories of type and size indicated, in color and finish to match adjoining wall tile, and intended for installing by same method as adjoining wall tile.
 1. One soap holder with grab handle for each shower indicated.

2.4 THRESHOLDS

- A. General: Fabricate thresholds to sizes and profiles **indicated in drawing details** or required to provide transition between adjacent floor finishes. If deviating from given details, review profile with architect prior to fabrication.
 1. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
- B. Custom Quartz Thresholds: Match quartz product specified elsewhere for sills and wall caps.

2.5 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS

- A. General: Comply with ANSI A118.10 and ANSI A118.12.
 1. Product: Mapei "Aqua Defense" or an equivalent product from another manufacturer.
- B. Chlorinated-Polyethylene-Sheet Product: Nonplasticized, chlorinated polyethylene faced on both sides with high-strength, nonwoven polyester fabric, for adhering to latex-portland cement mortar; 60 inches.
 1. Product: Noble Company (The); Nobleseal TS or an equivalent product from another manufacturer.
- C. Professional, Cement-Based Waterproofing Membrane. Trowel applied, flexible, fiber-mesh-Reinforced waterproofing and crack isolation membrane for installation under ceramic tile and stone.
 1. Product: MAPEI COROPORATION; Mapelastic 315 or an equivalent product from another manufacturer.

2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.7 SETTING AND GROUTING MATERIALS

- A. Use non-shrink high strength grout for ceramic tilework.
- B. Manufacturers:
 1. Custom Building Products.
 2. Mapei
 3. Laticrete International
 4. TEC Specialty Products Inc.
 5. Bostik, Inc.

- C. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.1A and as specified below:
 - 1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.
- D. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1 and ISO 13007
 - 1. For wall applications, provide nonsagging mortar that complies with Paragraph C-4.6.1 in addition to the other requirements in ANSI A118.1 and ISO 13007 C2TES1P1.
- E. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4 and ISO 13007, consisting of the following:
 - 1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site.
 - a. For wall applications, provide nonsagging mortar that complies with Paragraph F-4.6.1 in addition to the other requirements in ANSI A118.4 and ISO 13007 C2TES1P1.
- F. Sand-Portland Cement Grout: ANSI A108.10 and ISO 13007 CG2WA, composed of white or gray cement and white or colored aggregate as required to produce color indicated.
- G. Epoxy/Resin-Based Grout: ISO 13007 RG 100%-solids epoxy grout, with high chemical, stain, and enzymatic resistance.
 - 1. For floor and base in kitchen area: MAPEI, Kerapoxy IEG.

2.8 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics required.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
 - 1. Products:
 - a. Bostik; Chem-Calk 550.
 - b. Mameco International, Inc.; Vulkem 245.
 - c. Tremco, Inc.; THC-900.

2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
 - 1. Metal Edge Strips: Angle or L-shaped brushed aluminum or stainless steel, height to match tile and setting-bed thickness.
- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- C. Grout Sealer: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
- D. Metal Edge Strips: Provide metal strips (manufactured by Schluter) along tile edges and transitions that do not include specialty tile trim units. Metal edges shall be installed at the top of all

porcelain corridor wall tile, and at some floor tile transitions (as indicated in the drawings). Metal edges shall be installed at stair nosing (as indicated in the drawings).

2.10 MIXING MORTARS AND GROUT

- A. Use epoxy based grout for floors and cove base on walls conforming to ISO 13007 R2 and ISO 13007 RG Enzyme resistant formula, respectively. Equal to Mapei "OptiColor".
- B. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- C. Add materials, water, and additives in accurate proportions.
- D. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
 - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.
 - 3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- B. Provide concrete substrates for tile floors installed with adhesives or thin-set mortar that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
 - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
 - 2. Remove protrusions, bumps, and ridges by sanding or grinding.

3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Use crack isolation mat where poured gypsum is used for leveling.
- H. Grout tile to comply with requirements of the following tile installation standards:
 - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

3.4 WATERPROOFING INSTALLATION

- A. Use bonded waterproof membrane together with fiberglass tape in corners for floors and minimum 18" up walls for wet locations.
- B. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
 - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
- B. Joint Widths: Install tile on floors with joint widths that are recommended by the manufacturer for specific tile units.
- C. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated.
 - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- D. Grout Sealer: Apply grout sealer to cementitious grout joints according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

- E. Cover finished work with Kraft paper for minimum 72 hours during drying.

3.6 WALL AND CEILING TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards.
- A. Joint Widths: Install tile on walls with joint widths that are recommended by the manufacturer for specific tile units.

3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove latex-portland cement grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. Prohibit foot and wheel traffic from tiled floors for atleast seven days after grouting is completed.

3.8 FLOOR TILE INSTALLATION SCHEDULE

- A. Tile Installation FTI-#1: Interior porcelain floor tile on concrete with thickset mortar bed and cleavage membrane (at Restrooms where slab is recessed): **TCA F111** at locations other than slab-on-grade, **TCA F112** at slab-on-grade locations.
 - 1. Tile Type: See Finish Schedule.
 - 2. Mortar bed, reinforcing, and cleavage membrane: A108.1A
 - 3. Cementitious bond coat: ANSI A118.4 or better
 - 4. Grout: Latex portland cement grout (Ultracolor Plus FA by Mapei or equivalent)
 - 5. Grout Sealer: UltraCare by Mapei or equivalent.
- B. Tile Installation FTI-#2: Interior quarry floor tile on concrete with thickset mortar bed and cleavage membrane (at Kitchen, Serving and Cleaning areas where slab is recessed 3"); **TCA F114**
 - 1. Tile Type: See Finish Schedule.
 - 2. Mortar bed, reinforcing, and cleavage membrane: A108.1A
 - 3. Cementitious bond coat: ANSI A118.4 or better
 - 4. Grout: Epoxy grout (Kerapoxy IEG by Mapei or equivalent)
- C. Tile Installation FTI-#3: Interior porcelain floor tile (at thin-set applications with no floor recess); **TCA F113** at locations other than slab-on-grade, **TCA F112** slab-on-grade locations.
 - 1. Tile Type: See Finish Schedule.
 - 2. Cementitious bond coat: ANSI A118.4 or better
 - 3. Crack isolation membrane: ANSI A118.12
 - 4. Grout: Latex portland cement grout (Ultracolor Plus FA by Mapei or equivalent)
 - 5. Grout Sealer: UltraCare by Mapei or equivalent.

3.9 WALL TILE INSTALLATION SCHEDULE

- A. Tile Installation WTI-#1: Interior porcelain wall tile over cementitious backer units (in Corridors and other locations specified); **TCA W244C**.
 - 1. Tile Type: See Finish Schedule.
 - 2. Cementitious bond coat: ANSI A118.4 or better
 - 3. Grout: Latex portland cement grout (Ultracolor Plus FA by Mapei or equivalent)

- B. Tile Installation WTI-#2: Interior ceramic wall tile over glass mat, water-resistant backing board (in Restrooms, Kitchen, and other locations specified); **TCA W245**.
 - 1. Tile Type: See Finish Schedule.
 - 2. Cementitious bond coat: ANSI A118.4 or better.
 - 3. Waterproofing membrane (Aquadefense by Mapei or equivalent)
 - 4. Grout: Latex portland cement grout (Ultracolor Plus FA by Mapei or equivalent)
 - 5. Grout Sealer: UltraCare by Mapei or equivalent.

- C. Tile Installation WTI-#3: Interior ceramic wall tile over glass mat, water-resistant backing board (shower receptors); **TCA B420**.
 - 1. Tile Type: See Finish Schedule.
 - 2. Cementitious bond coat: ANSI A118.4 or better.
 - 3. Waterproofing membrane (Aquadefense by Mapei or equivalent)
 - 4. Grout: Latex portland cement grout (Ultracolor Plus FA by Mapei or equivalent)

END OF SECTION 093013

SECTION 095100 – CEILING SUSPENSION

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide and install ceiling suspension systems, complete, as shown on Drawings and as specified for the following ceiling finish systems:
 - 1. Gypsum Board Ceilings, coordinated with the Work of Section 09 29 0 – Gypsum Board.
 - 2. Lay-in Acoustical Ceilings, coordinated with the Work of Section 09 51 13 – Acoustical Ceilings.
 - 3. Lay-in Acoustical Ceilings for MRI rooms, including non-ferrous suspension components, coordinated with the Work of Section 09 51 13 – Acoustical Ceilings.
- B. Work Specified Elsewhere:
 - 1. Section 01410 – Testing and Inspection Services
 - 2. Section 050500 – Metal Fasteners.
 - 3. Section 083113 – Access Panels.
 - 3. Section 092216 – Non Structural Metal Framing.
 - 4. Section 095113 – Acoustical Ceilings.
 - 5. Divisions 15 and 16 – Mechanical and Electrical Work in Suspended Ceilings.

1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - 1. C635; Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 2. C754; Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum.
 - 3. C841; Standard Specification for Installation of Interior Furring and Lathing.
 - 4. C1063; Standard Specification for Installation of Lathing and Furring for Portland Cement-Based Plaster.

5. C636; Standard Specification for Installation of Metal Suspension System for Acoustic Tile and Lay-In Panels.
 6. Cisca Ceiling Systems Installation Handbook.
- B. International Building Code (IBC) with 2003 Utah Amendments.

1.3 SUBMITTALS

- A. Comply with requirements of Section 01330 – Submittal Procedures.
- B. Samples:
1. Exposed Suspension System Components: 12-inch-long piece of each item specified.
- C. Shop Drawings: Show following:
1. Layout of suspension systems, location of hangers, seismic braces and trapezes, indicating location of fixed and free side of layouts.
 2. Hanger spacing and fastening details.
 3. Trapeze details.
 4. Splicing method for main and cross runners.
 5. Support at ceiling fixtures and air diffusers.
 6. Change in level details.
 7. Locations and dimensions of access panels, light fixtures, supply and exhaust grilles and diffusers, sprinkler heads, speakers, and detection devices.
 8. Seismic control details.
 9. Develop and coordinate location of all Work which is to be located in ceiling with the Sections involved per Section 01330 – Submittal Procedures prior to making shop drawing submittal.
- D. Product Data: Manufacturer's information on materials, fabrication, and installation. Provide certification of flame spread rating and UL classification.

1.4 QUALITY ASSURANCE

- A. Allowable Tolerances:
1. Deflection: Do not exceed a maximum of $L/360$ of span.
 2. Level: Do not deviate from level in excess of $1/8$ inch in 12 feet.
- B. Testing:

1. If required by local authority, special inspection services may be implemented, refer to Section 01410 – Testing and Inspection Services.
2. Fasteners: As specified in Section 05050 – Metal Fasteners.

1.5 PRE-INSTALLATION CONFERENCE

- A. Comply with requirements of Section 01315 – Project Meetings.
- B. Arrange a conference at the job site to coordinate interior wall, partition and ceiling installation, to be attended by the Owner, Architect, Contractor, and personnel involved in the actual manufacture and installation of the Work of the following Sections:
 1. Section 07220 – Acoustical Insulation.
 2. Section 07840 – Fire Stopping and Smoke Seals.
 3. Section 09110 – Interior Wall Framing.
 4. Section 09120 – Ceiling Suspension.
 5. Section 09250 – Gypsum Board.
 6. Section 09265 – Shaft Wall Systems.
 7. Section 09510 – Acoustical Ceilings.
 8. DIVISION 15 – Mechanical.
 9. DIVISION 16 – Electrical.

1.6 PRODUCT HANDLING

- A. Delivery: Deliver products and materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
- B. Damaged Items: Remove items delivered in broken, damaged, rusted, or unlabeled condition from Project site immediately.
- C. Manufacturer's Recommendations: Follow additional delivery, storage, and handling requirements of manufacturer.

1.7 PROJECT CONDITIONS

- A. Concealed Work: Ensure that work concealed by suspended ceilings be complete, tested if required, inspected, and approved prior to commencement of installation of materials specified herein.
- B. Environmental Conditions: Do not commence installation until area has been closed in, and temperature and humidity conditions are similar to those expected during building occupancy.

- C. Wet Work: Complete and cured, prior to commencement of installation of suspended ceilings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framing:

1. General: Types specified are products of Western Metal Lath Company. Structural characteristics and quality of substitutions shall meet or exceed those of types specified and referenced standards.
2. Main Runners: 1-1/2-inch-deep cold-rolled (0.475 pound/foot) or hot-rolled (1.12 pound/foot) steel channels, galvanized for exterior work and rust-inhibitive coated for interior work.
3. Cross Furring: 3/4-inch-deep cold- or hot-rolled (0.3 pound/foot) steel channels, galvanized for exterior work and rust-inhibitive coated for interior work.
4. Furring Channels: 7/8-inch hat-shaped channels, 25-gauge hot-rolled channel at gypsum board ceilings; rust inhibitive finish.
5. Clips: Galvanized steel, of sizes and shapes shown. 16-gauge, except as otherwise shown.

B. Fasteners:

1. Sheet Metal Screws: To suit channel gauge, as specified in Section 09110 – Metal Support Systems.
2. Expansion Bolts:
 - a. Tie Wire: Hilti Kwik Bolt HKT 14, Ramset/Red Head TW, or equal, with minimum 1-1/2-inch embedment.
 - b. Others: As specified in Section 05050 – Metal Fasteners.
3. Powder-Actuated Devices (PAD's):
 - a. As specified in Section 05050 – Metal Fasteners and as follows:
 - 1) Size: 0.145-inch diameter with 15/16-inch minimum penetration.
 - 2) For Attachment of Ceiling Clips: Hilti DN 27 P8T, or equal.
4. Pop Rivets: 3/16-inch-diameter plated steel.
5. Machine Bolts: ASTM A307, Grade A, regular hexagon head type with ASTM A563, Grade A nuts. 1/4-inch size unless otherwise shown.

- C. Hanger, Bracing and Tie Wires:
1. FS QQ-W-461H, Finish 5, Class 1, soft temper or ASTM A 641, Class 1 coating, soft temper.
 2. Minimum gauges:
 - a. Hangers, 8.
 - b. Diagonal bracing wire, 12.
 - c. Single-strand tie wire, 16.
 - d. Double-strand tie wire, 18.
- D. Welding Electrodes: AWS, low hydrogen type, as required.
- E. Ceiling Clips: "BERC2" Clips in conformance with IBC Seismic category D, E, and F requirements for specified ceiling grid systems.
- F. Seismic Brace:
1. General: Provide compression post and four 12-gauge galvanized steel wires splayed at 45 degrees vertically and spaced at 90 degrees horizontally to each other and attached to main runner or grid member with 2-inches of compression post.
 2. Wire Attachment: PAD devices not permitted for attachment of brace wires. Fasten bracing wires at each end with not less than 4 tight turns within distance of 1-1/2 inches, except machine made wire turns, where both strands have been deformed or bent in wrapping, need not comply with 1-1/2-inch distance requirement as long as turns are tight as possible and four in number.
- G. Compression Posts: Provide compression posts as shown on Drawings and as specified, including:
1. Angle Strut Type: Steel sheet angles or channels, not less than 16-gauge, L/R ratio of 200 maximum.
 2. EMT Type: Electrical metallic tubing, diameters shown.
 3. Metal Stud Type: 2-inch by 4-inch steel stud, 16-gauge. Attach to main channel with three No. 10 screws. Attach to structure per drawings.
 4. Proprietary Type: Use at Contractor's option in lieu of angle strut or EMT types. USG's Donn Series VSA Compression Post, or equivalent, galvanized steel telescoping post with top clip, bulb clip, guide ring, and locking device. Provide size recommended by manufacturer for span.
- H. Suspension System for Acoustical Ceilings:

1. General: Provide each component as products of a single manufacturer.
2. Type: Comply with ASTM C 635 Structural Classification as "Heavy Duty" Systems, for direct hung installation with interlocking main runners and cross runners. Roll-formed grid components composed of deuble web hot-dipped galvanized steel.
 - a. Structural Classification: UL Certified in compliance with CBC Chapter 16 criteria.
3. Manufacturer: CertainTeed, Armstrong World Industries; USG Interiors, Inc; Chicago Metallic;. Products from CertainTeed are the Basis-of-Design for coordinated suspension components and acoustical ceiling panels.
4. Grid System:
 - a. For use with the following acoustic ceiling types: ACP-1, ACP-2, ACP-3 and ACP-4 as specified in Section 09 51 13 – Acoustical Panel Ceilings
 - b. Manufacturer: CertainTeed
 - c. Type: CertainTeed Classis Stab System, Heavy duty 15/16" Tee System; and 15/16" wall molding; including CertainTeed Seismic Perimeter Clip for seismic categories D, E and F.
 - d. Surface Finish: Baked polyester paint. Color: White
5. Typical Perimeter Angles: With matching corner caps and splice pieces; same material as that of exposed suspension system members, 15-gauge with hemmed edge, typical.
 - a. Finish: Baked polyester paint. Match adjacent grid system.
7. Slip Joints: MM Systems Corp.'s Series DX-100, or equal, white polyvinyl-chloride flexible extrusion for 1-inch-wide joint.
8. Slotted Angle Spacer: Slotted angles or channels with spring steel diamond points which snap tight to prevent movement of strut.
9. Miscellaneous Accessories: Manufacturer's standard for use with suspension system furnished; furnish as required.
- I. Sound Isolation Clips: As specified in Section 09110 – Non-Load Bearing Wall Framing.
- J. Miscellaneous: Provide manufacturer's standard miscellaneous items and accessories suitable for use intended and required for complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine conditions under which ceiling suspension systems are to be installed. Give notification in writing, of conditions detrimental to proper and timely completion of Work. Proceed only when conditions are satisfactory.

3.2 INSTALLATION

- A. Hanger Wires:
 - 1. Spacing:
 - a. For Gypsum Board, Metal Ceilings, and Acoustical Ceilings: 4-foot centers maximum.
 - 2. Clearance: Not less than 6-inches between hanger wires and unbraced ducts, pipes, and conduit.
 - 3. Attachment to Structure Above: Use wire pigtail embedded in concrete, tie wire type expansion bolt, or PAD with ceiling clip, as appropriate.
 - 4. Hanger Wires: Fasten hanger wires to attachment device at structure above with not less than 3 tight turns within distance of 1-1/2-inches, except machine-made wire turns, where both strands have been deformed or bent in wrapping, need not comply with 1-1/2-inch distance requirement as long as turns are as tight as possible and 3 in number.
 - 5. Wire Size:
 - a. For Gypsum Board Soffits and Ceilings: 8-gauge.
 - b. For Acoustical and Metal Panel Ceilings: 12-gauge at inaccessible and 10-gauge at accessible areas.
 - 6. Out-Of-Plumb Wires: Install hanger wires as near plumb as possible. Where hanger wires are more than 1 (horizontal) to 6 (vertical) out of plumb, provide counterbrace wires.
- B. Trapezes: Provide trapezes or other supplementary support members at obstructions in order to maintain specified hanger spacing. Provide additional hangers, struts or braces as required at all ceiling breaks, soffits or discontinuous areas. Counter-balance out-of-plumb wires as specified.
- C. Additional Hanger Wires: Provide as required at ceiling breaks, soffits, and discontinuous areas.
- D. Gypsum Board Ceiling Suspension System:
 - 1. Runner Channels:

- a. Spacing: 4-foot maximum centers.
 - b. Attachment: Saddle tie with hanger wires at 4-foot maximum centers. Make 2 loops and secure with not less than 3 turns in 1-1/2-inch maximum distance.
 - c. Splice: Lap and interlock flanges 12 inches minimum and tie near each end with double loops of 16-gauge tie wire.
- 2. Furring Channels:
 - a. Spacing: 16-inch maximum centers.
 - b. Attachment: Saddle tie with 16-gauge tie wire to runner channels and secure with no less than 3 tight turns.
 - c. Splice: Lap and interlock 8-inches minimum and tie near each end with double loops of 16-gauge tie wire.
- E. Acoustical Ceiling Panel and Metal Ceiling Panel suspension system:
 - 1. General: Install per Reference Standards, manufacturer's instructions, and reviewed shop drawings.
 - 2. Main Grid Members:
 - a. Spacing: 4-foot maximum centers.
 - b. Attachment: Tie with hanger wire secured with not less than 3 turns in 1-1/2-inch maximum distance.
 - c. Lighting Fixtures, Air Terminals, and Other Services Less Than 56 Pounds in Weight: Secure with slack hanger wires at two corners.
 - d. Lighting Fixtures, Air Terminals, and Other Services Greater Than 56 Pounds in Weight: Secure with hanger wires at four corners and as shown on Drawings.
 - 3. Secondary Grid Members:
 - a. Spacing: 2-foot maximum centers.
 - b. Attachment: Form 2-foot by 2-foot grid with positive splices.
- F. Seismic Restraint:
 - 1. General: Provide as follows for each type suspension system.
 - 2. Spacing:
 - a. Areas Less Than 96-Square Feet:

- 1) No Dimension Greater Than 12-Feet: No bracing required.
- 2) Dimension Greater Than 12-Feet: Provide bracing.
- b. Areas Greater Than 96-Square Feet: Provide brace for each 96-square feet or fraction thereof.
- c. Maximum Brace Spacing: 8-feet by 12-feet.
- d. Maximum Distance From Walls: 1/2-brace spacing in direction perpendicular to plane of wall.
3. Seismic Brace:
 - a. General: Provide compression post and four 12-gauge galvanized steel wires splayed at 45 degrees vertically and spaced at 90 degrees horizontally to each other and attached to main runner or grid member with 2-inches of compression post.
 - b. Wire Attachment: Powder-actuated devices not permitted for attachment of brace wires. Fasten bracing wires at each end with not less than 4 tight turns within distance of 1-1/2-inches, except machine made wire turns, where both strands have been deformed or bent in wrapping, need not comply with 1-1/2-inch distance requirement as long as turns are as tight as possible and 4 in number.
- I. Access Panels: Frame as required for access panels furnished under Divisions 15 and 16 and specified under Section 08310 –Access Panels.

END OF SECTION

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.

1.3 DEFINITIONS

- A. LR: Light Reflectance coefficient.
- B. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch-square samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12-inch-long Samples of each type, finish, and color.
- C. Delegated-Design Submittal: For seismic restraints at ceiling systems not attached to walls (cloud ceilings).
 - 1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

- A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.
- B. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.
 - 2. Suspension System: Obtain each type through one source from a single manufacturer.
- C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
 - 1. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
 - 2. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products with the following characteristics.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range

that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 WATER-FELTED, MINERAL-BASE REVEAL EDGE ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING.

- A. Classification: Provide panels complying with ASTM E 1264 for Type III, mineral base with painted finish; Form 2, water felted; and pattern as follows:
 - 1. Pattern: C (perforated).
- B. Color: White
- C. LR: Not less than 0.75.
- D. NRC: Not less than 0.50.
- E. Edge Detail: Reveal sized to fit flange of exposed suspension system members – "SLT" (Tegular) profile.
- F. Thickness: 5/8 inch.
- G. Size: 24 x 48 inches. At areas where 24 x 24 ceiling tiles are shown on the drawings, provide Armstrong's "Second Look", scored 24 x 48 ceiling tiles (or equivalent by another manufacturer). The scored tiles shall match the same product line as the true 24 x 48 tiles.

2.4 MEMBRANE-FACED WASHABLE OVERLAY GYPSUM LAY-IN PANEL CEILING.

- A. Classification: Provide panels complying with ASTM E 1264 for Type XII, glass-fiber base with membrane-faced overlay; Form 1, plastic.
 - 1. Pattern: E (lightly textured).
- B. Color: White.
- C. LR: Not less than 0.75.
- D. CAC: Not less than 45.
- E. Edge Detail: Square
- F. Thickness: 1/2 inch.
- G. Size: 24 by 48 inches.

2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.

- a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
- D. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch-diameter wire.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

2.6 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with prefinished 15/16-inch-wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. Face Design: Flat, flush.
 - 3. Cap Material: Steel cold-rolled sheet.
 - 4. Cap Finish: Painted white.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers:
 - 1. Armstrong World Industries, Inc.
 - 2. Celotex Corporation; Architectural Ceilings Marketing Dept.
 - 3. Chicago Metallic Corporation.
 - 4. Fry Reglet Corporation.
 - 5. USG Interiors, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
 - 2. For exposed perimeter ceiling edges, provide edge moldings fabricated to match plan, profile and detail as shown on drawings. Provide 2-inch vertical exposure and as otherwise shown on the drawings.
 - a. Armstrong 'Axiom' or architect's approved equal.
 - b. Color: Global White or as indicated
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Do not attach hangers to steel deck tabs.
 - 6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
 - 1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 - 2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. Install panels with pattern running in one direction parallel to long axis of space.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
 - 3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT WALL BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Resilient wall base.
 - 2. Resilient floor transitions and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After post installation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.

- C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.
- D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
 - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

- A. Product Standard: ASTM F 1861, Type TS (rubber), Group I (solid, homogeneous).
- B. Rubber Wall Base: Provide rubber wall base complying with the following and as indicated on the Drawings:
 - 1. Products: As follows:
 - a. Burke Flooring Products Division – Burke Industries, Inc.
 - b. Flexco Div. – Textile Rubber Co.
 - c. Johnson Rubber Co., Inc.
 - d. R.C. Musson Rubber Co, Inc.
 - e. Roppe Rubber Corp.
 - 2. Color and Pattern: See Finish Schedule.
 - 3. Style: Traditional Base with Toe
 - 4. Minimum Thickness: 1/8 inch.
 - 5. Height: 4 inches.
 - 6. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet.
 - 7. Surface: Smooth.

2.2 RESILIENT ACCESSORIES

- A. Rubber Accessory: Provide rubber accessory molding complying with the following:
 - 1. Products: As follows:
 - a. Burke Flooring Products Division – Burke Industries, Inc.
 - b. Flexco Div. – Textile Rubber Co.
 - c. Johnson Rubber Co., Inc.
 - d. R.C. Musson Rubber Co, Inc.
 - e. Roppe Rubber Corp.
 - f. RCA Rubber Company
 - 2. Color and Pattern: Match rubber base.
 - 3. Product Description: Carpet edge for glue-down applications. Reducer strip for resilient flooring. Tile and carpet joiner.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. General: Install resilient products according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
 - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
 - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
 - 3. Do not stretch base during installation.
 - 4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
 - 5. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 6. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.
- D. Apply resilient products to stairs as indicated and according to manufacturer's written installation instructions.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
 - 1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
 - 2. Sweep or vacuum horizontal surfaces thoroughly.
 - 3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
 - 4. Damp-mop or sponge resilient products to remove marks and soil.
- B. Protect resilient products against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by resilient product manufacturer.

END OF SECTION 096513

SECTION 096800 - CARPET

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. ~~Tile Carpeting as shown on the Drawings.~~
 - 2. ~~Broadloom Carpeting as shown on the Drawings.~~
 - 3. Non-Recessed, Entry Mat Carpeting as shown on the Drawings.

1.3 SUBMITTALS

- A. Product Data: Include installation recommendations for each type of substrate required.
- B. Shop Drawings: Show the following:
 - 1. Type, color, and location of edge, transition, and other accessory strips.
 - 2. Transition details to other flooring materials.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

1.5 PROJECT CONDITIONS

- A. General: Comply with CRI 104, Section 6.1, "Site Conditions; Temperature and Humidity."

Environmental Limitations: Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.7 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials, from the same product run, that match the products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Carpet Tile and Entry Mat Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

2. Broadloom Carpet: Full-width rolls equal to **5** percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. General: See Finish Schedule on sheet A603A for carpet manufacturer, style, model, color, accent patterns and other additional information.
- B. Products indicated in the Finish Schedule are the basis of design. If the flooring contractor wishes to submit an alternate product (comparable in style, color, construction, and performance), submissions shall be made to the architect for review prior to bidding and with adequate time to review the alternate product. Submission shall include product sample and product data.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided by or recommended by the following:
 1. Carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and that is recommended by the following:
 1. Carpet manufacturer.
- C. Seaming Cement: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.
- D. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.
- E. Edge Banding: Where carpet base is indicated on the Drawings, the Contractor shall provide edge banding in accordance with the manufacturer's written recommendations. Edge band colors shall be selected by the Architect from the manufacturer's full range of colors.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Verify that substrates and conditions are satisfactory for carpet installation and comply with requirements specified.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by the following:
 - a. Carpet manufacturer.
 2. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and carpet manufacturer's written installation instructions for preparing substrates indicated to receive carpet installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by the following:
 - 1. Carpet manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

- A. Direct-Glue-Down Installation: Comply with CRI 104, Section 8, "Direct Glue-Down Installation."
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
 - 1. Level adjoining border edges.
- C. Do not bridge building expansion joints with carpet.
- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders, unless noted otherwise.
- H. Install Tile Carpeting in accordance with Carpet and Access Floor manufacturers' written recommendations.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
 - 2. Remove yarns that protrude from carpet surface.
 - 3. Vacuum carpet using commercial machine with face-beater element.

- B. Protect installed carpet to comply with CRI 104, Section 15, "Protection of Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer.

END OF SECTION 096800

SECTION 099000 - PAINTING

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 surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Prefinished items include the following factory-finished components:
 - a. Architectural woodwork and casework.
 - b. Metal toilet enclosures.
 - c. Metal lockers.
 - d. Elevator entrance doors and frames.
 - e. Elevator equipment.
 - f. Light fixtures.
 - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
 - a. Furred areas.
 - b. Ceiling plenums.
 - c. Pipe spaces.
 - d. Duct shafts.
 - e. Elevator shafts.
 - 3. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
 - 1. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 - 1. Product name or title of material.
 - 2. Application instructions.
 - 3. Color name and number.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
 - 1. Quantity: Furnish the Owner with an additional 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.
 - 1. Benjamin Moore & Co. (Moore).

2. Glidden Co. (The) (Glidden).
3. ICI Dulux Paint Centers (ICI Dulux Paints).
4. PPG Industries, Inc. (PPG).
5. Pratt & Lambert, Inc. (P & L).
6. Sherwin-Williams Co. (S-W).

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: Provide color selections shown on the Finish Schedule. Architect will provide supplemental instruction prior to painting showing locations of field and accent paint colors – notify architect prior to ordering painting materials that the project is ready for this instruction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 1. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel 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.

2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 3. Ferrous Metals: Clean ungalvanized 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 the Steel Structures Painting Council's (SSPC) recommendations.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 3. Provide finish coats that are compatible with primers used.
 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 6. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 7. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer on metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
 - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
 - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

- A. Ferrous Metal and Galvanized Metals: Provide the following system or comparable one from one of the approved manufacturers.
 - 1. Semi-Gloss Finish
 - Primer: Pro Industrial Pro-Cryl Universal Metal Primer, B66-310, <100 g/L VOC
 - 1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
 - 2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
- B. Exposed Concrete: Provide anti graffiti coating for all exposed exterior concrete retaining walls and benches:
 - 1. S-W Anti-Graffiti Coating or Architect's approved equal.
- C. Manufactured Stone Veneer Wainscot, Brick Veneer, and Concrete Masonry units: Provide water-based graffiti and water repellent as follows:
 - 1. "Sure Klean Weather Seal Blok-Guard & Graffiti Control II" Manufactured by Prosoco or Architect's approved equal. Install per manufacturer's recommendations.
 - 2. Graffiti repellent is to be installed from bottom of wall to a height of 8'-0" on all exterior building and site walls.
- D. Concrete Site Flatwork (including sidewalks driveways, etc.)
 - 1. 100% acrylic topical sealer by Concrete Sealers USA, low gloss.

3.7 INTERIOR PAINT SCHEDULE

- A. ~~Concrete Masonry Units: Provide the following finish system over interior concrete masonry block units scheduled to receive paint or a comparable one from one of the approved manufacturers.~~
- ~~1. ~~Satin Finish — Low Odor Zero VOC Topcoat~~
~~Primer: PrepRite Block Filler, B25W25, <50 g/L VOC~~
~~1st coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC~~
~~2nd coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC~~~~
 - ~~2. ~~Semi-Gloss Finish — Water-Based Epoxy System~~
~~Primer: Loxon Block Surfacers, A24W200, <100 g/L VOC~~
~~1st coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC~~
~~2nd coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC~~~~
- B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces or a comparable one from one of the approved manufacturers:
1. Satin Finish — Low Odor Zero VOC System
Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600 0 g/L VOC
1st coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC
2nd coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC
 2. Semi-Gloss Finish - Water-Based Epoxy System
Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC
1st coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC
2nd coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC
- C. Woodwork and Hardboard (Stained Doors, Frames, Trim and Chair Rails): Provide the following finish systems over new, interior wood surfaces or a comparable one from one of the approved manufacturers:
1. Wood — Stained Doors, Frames, Trim and Chair Rails
Stain: Wood Classics 250 g/l Stain, A49W800 series, 250 g/L VOC
2nd coat: Wood Classics WB Polyurethane A68, <350 g/L VOC
3rd coat: Wood Classics WB Polyurethane A68, <350 g/L VOC
- D. Non-Ferrous Metal & Ferrous Metal (Doors, Frames and Miscellaneous Metals): Provide the following finish systems over new, interior wood surfaces or a comparable one from one of the approved manufacturers:
1. Semi-Gloss Finish
Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC
1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
- E. Non-Ferrous Metal & Ferrous Metal (High Performance System for Handrails): Provide the following finish systems over new, interior wood surfaces or a comparable one from one of the approved manufacturers:
1. Egg-Shell or Semi-Gloss Finish

Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC

1st coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or
Gloss, B73-300 series, 0 g/L VOC

2nd coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or
Gloss, B73-300 series, 0 g/L VOC

- F. Galvanized Metal Decking & Ferrous Decking — Including Bar Joists: Provide the following finish systems over new, interior wood surfaces or a comparable one from one of the approved manufacturers:

1. **Flat, Egg-Shell**

Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC

1st coat: Low VOC Waterborne Acrylic Dryfall, Flat B42W81, Eg-Shel B42W82, Semi-
Gloss, B42W83,
All sheens <50 g/L VOC

2nd coat: Low VOC Waterborne Acrylic Dryfall, Flat B42W81, Eg-Shel B42W82, Semi-
Gloss, B42W83,
All sheens <50 g/L VOC

- G. Concrete Slabs with Sealers

1. "Euco Diamond Hard" liquid densifier and sealer, manufactured by Euclid Chemical or equivalent product approved by the architect and owner. Install per manufacturer's recommendations for polished concrete finish.

- ~~H. Interior Masonry (Concrete Masonry Units) that are required to be honed on the finish plans: Provide the following systems for all exposed interior concrete masonry units not required to be painted:~~

- ~~1. "Sure Klean Weather Seal Blok Guard & Graffiti Control II" Manufactured by Prosoco or Architect's approved equal. Install per manufacturer's recommendations.~~

END OF SECTION 099000

SECTION 107113: EXTERIOR SUN CONTROL DEVICES

PART 1 GENERAL

1.1 Summary

- A. This section includes products to assist in controlling the effects of the sun.
- B. Related work specified elsewhere
 - 1. 84413 Aluminum Storefront and Entrances
- C. Work included in this section.

The extent of the extruded aluminum sunshade system is shown on the contract drawings and hereby defined to include all sunshade devices of the type shown and specified herein.

1.1 Industry Standard

A. Reference:

Products and executions are specified in this section by reference to the following industry and/or trade specifications or standards of the following:

National Association of Architectural Metal Manufacturers (NAAMM), the Aluminum Association (AA), American Architectural Manufacturers Association (AAMA).

1.2 Qualifications

A. Manufacturers:

a. Standard

For the purpose of designation type and quality for the work under this section, drawings and specifications are based on the products manufactured by **Architectural Grilles and Sunshades, Inc. (AGS, Inc.)**; 22442, Fey Drive, Frankfort, IL 60448. Phone: (708) 479-9458, Fax: (708) 479-9478. Email: ***Nathan.s@agsshade.com***

b. Additional Acceptable Manufacturers:

Subject to compliance with these specifications, products as manufactured by:

- 1. Pittco Architectural Metals
- 2. Active Glass Co.

1.3 Submittals:

- A. Product data: Manufacturers technical and descriptive data.
- B. Shop Drawings:
 - a. Submit for architect's approval prior to commencement of any work or fabrication under this section, _ sets of detail shop drawings showing all areas of work profiles and sections of all components, finishes and fastening details.

- C. Structural Calculations: submit comprehensive analysis of design loads, dead, live, snow, wind and thermal movements. Calculations shall be stamped and signed by a professional engineer registered in the jurisdiction where the project is located.
- D. Warranties:
 - a. The work in this section shall be guaranteed against defects in material and workmanship for a period of one (1) year from date of acceptance of the building. Contractor shall replace and repair any defects at no cost to the owner.

1.4 Components:

A. Shipping and Handling:

Deliver materials to the job site ready for erection. Assembled units to be packaged and shipped to prevent damage during freight and storage on site.

PART 2 - PRODUCTS

2.1 Materials:

A. General: Metal shall be free from defects impairing strength, durability, or appearance.

- 1. Aluminum – ASTM B 221, alloys 6063-T5 and 6063-T6 for extrusions. ASTM B 209, alloys 5052-H32 or greater.
- 2. Fasteners – Unless otherwise noted, fasteners shall be 300 series non-magnetic stainless steel. ASTM A-307, grade A or better.

2.2 Components:

- A. Sunshades component shall be **Ireland series “Galaway”** 6063 T5 extruded aluminum AGS, Inc.
- B. Outriggers shall be **42” outrigger with Airfoil blades** 6063 T5 extruded aluminum AGS, Inc.
- C. Fascia shall be **1-1/2” x 4 channel** 6063 T5 extruded aluminum AGS, Inc.
- D. Components shall be shop assembled in large practical sections to allow for immediate erection.

2.3 Aluminum Finish:

A. General:

Finish on exposed aluminum shall be compliant with the performance standards set forth in AAMA Specifications 2605-98, “Superior Performing Organic Coatings on Aluminum.”

B. Type:

Factory-applied, high performance, 70% Polyvinylidene Fluoride (PVDF) coating based on Elf Atochem Inc. Kynar 500 or Ausimont USA Inc. Hylar 5000 resin, formulated by a licensed paint manufacturer, and applied by paint manufacturer's warranty-approved applicator.

C. Pretreatment:

Applicator to pretreat the aluminum with solutions to remove organic and inorganic surface soils, remove residual oxides, followed by a chrome phosphate conversion coating - at minimum 40 mg/square foot – to ensure adhesion of paint to the aluminum.

D. Application:

One primer coat, one color coat, for a minimum of 1.2 mils of dry film thickness.

E. Color:

To be determined by the architect

OR

A. Class I, clear anodic finish: AA-M12C22A41 (Mechanical Finish: Chemical finished: etched, medium matte; anodic coating: Architectural class I, clear coating 0.018 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION:

3.1 Field Dimensions:

A. Verify conditions: Examine areas where work is to be performed and identify any conditions that could be detrimental to proper or timely completion.

B. General Contractor Shall field confirm openings and elevations as shown on shop drawings prior to fabrication.

C. Installation should not proceed until all conditions are satisfactory.

3.2 Erection:

A. Qualified installer needs to comply with manufacturer's installation instructions.

B. Verify all dimensions and the supporting structure and provide accurate field measurements, so that the sunshades will be properly designed, fabricated, and fitted to the structure.

C. Anchor Sunshade to the building per the architectural drawings.

D. A maximum of +/- 1/8" tolerance between any column to column spacing is acceptable.

E. Do not cut or trim any Sunshade components without written approval by AGS, Inc.

- F. Do not erect any damaged or deformed members. Remove or replace any damaged members in the erection process as directed by AGS, Inc.
- G. Set Sunshade units level, plumb, with uniform joints.
Qualified installer to erect after all adjacent painting, roofing and masonry has been completed.

3.3 Cleaning:

Clean exterior Sunshades surfaces to prevent buildup of dust and debris, refer to AGS, Inc. cleaning instructions based on the finish of the material

3.4 Protection:

Protect Sunshade materials after installation to prevent damage by other tradespersons.

End of Section 107113

SECTION 142400 - HYDRAULIC ELEVATORS

MACHINE ROOM-LESS HYDRAULIC PASSENGER ELEVATOR

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes: Machine room-less hydraulic passenger elevators as shown and specified. Elevator work includes:
 - 1. Standard pre-engineered hydraulic passenger elevators.
 - 2. Elevator car enclosures, hoistway entrances and signal equipment.
 - 3. Operation and control systems.
 - 4. Jack(s).
 - 5. Accessibility provisions for physically disabled persons.
 - 6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
 - 7. Materials and accessories as required to complete the elevator installation.
- B. Related Sections:
 - 1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
 - 2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
 - 3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
 - 4. Division 5 Metals:
 - a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
 - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
 - 5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
 - 6. Division 16 Sections:
 - a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
 - b. Emergency power supply, transfer switch and auxiliary contacts.
 - c. Heat and smoke sensing devices.
 - d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.
 - 7. Division 22 Plumbing
 - a. Sump pit and oil interceptor.
 - 8. Division 23 Heating, Ventilation and Air Conditioning
 - a. Heating and ventilating hoistways and/or control room.
- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the thyssenkrupp Elevator's proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side

of the door. For center opening doors, the controller is located on the right-hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.

25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc.

1.02 SUBMITTALS

- A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
 - 1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
 - 2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
 - 3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
 - 4. Indicate electrical power requirements and branch circuit protection device recommendations.
- C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- E. Metal Finishes: Upon request, standard metal samples provided.
- F. Operation and maintenance data. Include the following:
 - 1. Owner's manuals and wiring diagrams.
 - 2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
 - 1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
 - a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
 - 2. The manufacturer shall have a documented, on-going quality assurance program.
 - 3. ISO-9001:2000 Manufacturer Certified
 - 4. ISO-14001:2004 Environmental Management System Certified
 - 5. LEED Gold certified elevator manufacturing facility.
- B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:

1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
6. Section 407 in ICC A117.1, when required by local authorities
7. CAN/CSA C22.1 Canadian Electrical Code
8. CAN/CSA B44 Safety Code for Elevators and Escalators.
9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:

1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

F. Sustainable Product Qualifications:

1. Environmental Product Declaration:
 - a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
2. Material Transparency:
 - a. GOOD: Provide Health Product Declaration at any level
 - b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
 - c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
4. Living Building Challenge Projects: Provide Declare label for products specified.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

- A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

- A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 3 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
 - 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
 - 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
 - 3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Design based around thyssenkrupp Elevator's endura Machine Room-Less hydraulic elevator.

2.02 MATERIALS, GENERAL

- A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1-2010, CA Section 01350 as mentioned in 1.03.9 of this specification.
- B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
- C. Steel:
 - 1. Shapes and bars: Carbon.
 - 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
 - 3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.

- D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.
- E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.
- B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
- D. Guides: Slide guides shall be mounted on top and bottom of the car.
- E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.
- F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..
- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.
- H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit.
- I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

- J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
 2. An oil hydraulic pump.
 3. An electric motor.
 4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating – motors shall be capable of 80 starts per hour with a 30% motor run time during each start.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
 2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
 3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
 4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
 5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
 6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
 7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
 8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
 - 1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
 - 2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish.
 - 3. Typical door & frame finish: ASTM A 366 steel panels, factory applied powder coat finish.
- B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.
- C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details
- D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
 - 1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
 - 2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
 - 3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

- A. Car Enclosure:
 - 1. Walls: Cab type a steel shell design, reinforced cold-rolled steel with an applied panel design. The applied panels design, shall be arranged vertically on wood core panels covered on both sides with high pressure plastic laminate.
 - 2. Reveals and frieze: Factory applied powder coat
 - 3. Canopy: Cold-rolled steel with hinged exit.
 - 4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in a metal frame. Framework shall be finished with a factory applied powder coat finish.
 - 5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with No. 4 brushed stainless steel
 - 6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
 - a. Door Finish: Stainless steel panels: No. 4 brushed finish.

- b. Cab Sills: Extruded aluminum, mill finish.
 - 7. Handrail: Provide 1.5" diameter cylindrical metal on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, No. 4 brushed finish.
 - 8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
 - 9. Protection pads and buttons: Not required
- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
- 1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
 - 2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
 - 3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
 - 4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
 - 5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
 - 6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.

7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
 8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a No. 4 brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.
- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: Not Required
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Not Applicable

2.09 CONTROL SYSTEMS

- A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Service Panel – to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
1. Access to main control board and CPU
 2. Main controller diagnostics
 3. Main controller fuses
 4. Universal Interface Tool (UIT)
 5. Remote valve adjustment
 6. Electronic motor starter adjustment and diagnostics

7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
 8. Operation of auxiliary pump/motor (secondary hydraulic power source)
 9. Operation of electrical assisted manual lowering
 10. Provide male plug to supply 110VAC into the controller
 11. Run/Stop button
- C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- D. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.
- E. Special Operation: Not Applicable

2.10 HALL STATIONS

- A. Hall Stations, General: Provide buttons with white-illuminating or blue-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
1. Provide one pushbutton riser with faceplates having a No. 4 brushed stainless steel finish.
 - a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Position Indicator: Not Applicable
- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.
- B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

- C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 EXECUTION

3.01 EXAMINATION

- A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
 - 1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
 - 2. Comply with the National Electrical Code for electrical work required during installation.
- B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
- C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
- D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.
- E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
- G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

- H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.
- I. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.
- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
 - 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

- A. Elevator Qty. 1
1. Elevator Model Basis of Design: enduraMRL Above-Ground (1-stage)
 2. Elevator Type: Hydraulic Machine Room-Less, Passenger
 3. Rated Capacity: 3500 lbs.
 4. Rated Speed: 110 ft./min.
 5. Operation System: TAC32H
 6. Travel: 14'-0" from level 1 to 2
 7. Landings: 2 total
 8. Openings:
 - a. Front: 1
 9. Clear Car Inside: 6' - 8" wide x 4' - 3" deep
 10. Cab Height: 8'-0" standard
 11. Hoistway Entrance Size: 3' - 6" wide x 7'-0" high
 12. Door Type: Single Speed
 13. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
 14. Seismic Requirements: Zone 3+
 15. Hoistway Dimensions: 8' - 4" wide x 6'-3" deep
 16. Pit Depth: 4' - 0"
 17. Button & Fixture Style: Signa4 Signal Fixtures
 18. Special Operations: None

END OF SECTION 142400

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes painted markings applied to pavement.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include technical data and tested physical and performance properties.
- B. Shop Drawings: For pavement markings.
 - 1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
 - 2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of state or local DOT for pavement-marking work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4.4 deg C) for alkyd materials 55 deg F (12.8 deg C) for water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Benjamin Moore & Co.
 - 2. Columbia Paint & Coatings.
 - 3. Kwal Paint.

4. PPG Industries.
5. Pratt & Lambert.
6. Sherwin-Williams Company (The).

2.2 PAVEMENT-MARKING PAINT

- A. Pavement-Marking Paint (parking lot and driveway areas): MPI #32, alkyd traffic-marking paint.
 1. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.
- B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for a minimum of 30 days before starting pavement marking.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils (0.4 mm).
 1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.
 2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal. (0.72 kg/L).

3.3 PROTECTING AND CLEANING

- A. Protect pavement markings from damage and wear during remainder of construction period.
- B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 323113 - CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Chain-link fences.
 - 2. Gates: Swing
 - 3. Backstop.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Minimum Post Size: Determine according to ASTM F 1043 for framework up to 20 feet high, and post spacing not to exceed 10 feet.
 - 2. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified and on the following:
 - a. Wind Loads: As indicated on Structural Notes S001
 - b. Exposure Category: B
 - c. Fence Height: 6, 8, 12, 20 (as well as backstop)
 - d. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.
 - 1. Fence and gate posts, rails, and fittings.
 - 2. Chain-link fabric, reinforcements, and attachments.
 - 3. Gates and hardware.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show accessories, hardware, gate operation, and operational clearances.

- C. Delegated-Design Submittal: For chain-link fences and gate framework indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer.
- B. Product Certificates: For each type of chain-link fence and gate, from manufacturer.
- C. Product Test Reports: For framing strength according to ASTM F 1043.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For the following to include in emergency, operation, and maintenance manuals:
 - 1. Gate hardware.
 - 2. Polymer finishes

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer and installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of gate operators and controls.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated below:
1. Fabric Height: As indicated on Drawings.
 2. Steel Wire Fabric: Wire with a diameter of 0.148 inch (**9 gauge**)
 - a. Mesh Size: 2 inches.
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
 - c. Coat selvage ends of fabric that is metallic coated before the weaving process with manufacturer's standard clear protective coating.
 3. Selvage: Knuckled at both selvages.

2.2 FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:
1. Fence Heights: As Indicated on the Drawings.
 2. Heavy Industrial Strength: Material Group IA, round steel pipe, Schedule 40.
 - a. Line Post Sizes: 1-7/8" in diameter for 4' & 6' fences. 2-3/8" in diameter for 8' & 10' fences, but not less than required to comply with performance requirements.
 - b. End, Corner and Gate Posts (Terminal Posts): 2-3/8" in diameter for 4' & 6' fences, 2-7/8" in diameter for 8' & 10' fences
 3. Horizontal Framework Members: Intermediate, top, and bottom rails complying with ASTM F 1043. **Top and bottom rails shall be present on all fences.** Intermediate rail only necessary when height exceeds acceptable standards.
 - a. Top Rail: 1-5/8" in diameter
 - b. Bottom Rail: Standard diameter
 4. Brace Rails: Comply with ASTM F 1043.
 5. Metallic Coating for Steel Framing:
 - a. Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M or 4.0-oz./sq. ft. (1.22-kg/sq. m) zinc coating per ASTM A 653/A 653M.
 6. Polymer coating over metallic coating.
 - a. Color: Black, complying with ASTM F 934.

2.3 SWING GATES

- A. General: Comply with ASTM F 900 for gate posts and single and double swing gate types.
 - 1. Gate Leaf Width: as shown on the drawings.
 - 2. Gate Fabric Height: as shown on the drawings.
- B. Pipe and Tubing:
 - 1. Zinc-Coated Steel: Comply with ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framing.
 - 2. Gate Posts: Round tubular steel.
 - 3. Gate Frames and Bracing: Round tubular steel.
- C. Frame Corner Construction: Welded.
- D. Hardware:
 - 1. Hinges: 180-degree inward.
 - 2. Latches permitting operation from both sides of gate with provision for padlocking accessible from both sides of gate.

2.4 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post Caps: Provide for each post.
 - 1. Provide line post caps with loop to receive tension wire or top rail.
- C. Rail and Brace Ends: For each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.
- E. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- F. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.106-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- G. Finish:
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. zinc.

- a. Polymer coating over metallic coating where fence is coated.

2.5 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout, recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 - 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.
 - 1. Install fencing on established boundary lines inside property line.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
 - 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 - 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Concealed Concrete (at new concrete locations): Top 2 inches below grade to allow covering with surface material.
 - b. Posts Set into Voids in Concrete (at existing sidewalk locations): Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete

with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 96 inches o.c.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
 - 1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- G. Intermediate and Bottom Rails: Install and secure to posts with fittings.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1 inch between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- J. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 ADJUSTING

- A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire

operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

1. controls and equipment.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 323119 – ORNAMENTAL SWING GATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

Contractor shall provide all labor, materials and appurtenances necessary for installation of the welded ornamental steel fence system defined herein at Lincoln Elementary School.

1.02 RELATED WORK

Section 312000 – Earth Moving
Section 033000 - Concrete

1.03 SYSTEM DESCRIPTION

The manufacturer shall supply the following gate

Model: Montage Plus

Style: Majestic™ design.

The system shall include all components (i.e., panels, posts, gates and hardware) required.

1.04 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

- ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM D523 - Test Method for Specular Gloss
- ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.06 SUBMITTAL

The manufacturer's literature shall be submitted prior to installation.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.08 PRODUCT WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from date of original purchase. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 – MATERIALS

Basis of Design: Montage Plus® - Steel Ornamental Fence System – Fusion Welded and Rackable

2.01 MANUFACTURER

The manufacturer, Ameristar Fence Products, Inc., in Tulsa, Oklahoma, shall supply the following gate.

Model: Montage Plus

Style: Majestic™ design.

The system shall include all components (i.e., panels, posts, gates and hardware) required.

2.02 MATERIAL

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft² (184 g/m²), Coating Designation G-60.

B. Material for pickets shall be 3/4" square x 18 Ga. tubing. The rails shall be steel channel, 1.5" x 1.4375" x 14 Ga. Picket holes in the rail shall be spaced 3.5" on center for 3" air space. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

2.03 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).

C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Commercial weight fences under ASTM F2408.

E. Gates with an out to out leaf dimension less than and including 72 inches shall be fabricated using Montage Plus ornamental panel material and 1-3/4" sq. x 14ga. gate ends. Gate leafs greater than 72 inches shall be fabricated using ForeRunner rails, 17 gauge pickets, intermediate uprights, gussets and 1-3/4" sq. x 14ga. gate ends. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus 1/4". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 30". The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

3.03 FENCE INSTALLATION MAINTENANCE

When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces;

1. Remove all metal shavings from cut area.
2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
3. Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed surfaces per steps 1-3 above will negate warranty. Ameristar spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray. Use of non-Ameristar parts or components will negate the manufactures' warranty.

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacture of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Montage Plus Posts		
Fence Posts	Panel Height	
2-1/2" x 16 Ga.	Up to & Including 6' Height	
Gate Leaf	Gate Height	
	Up to & Including 4'	Over 4' Up to & Including 6'
Up to 4'	2-1/2" x 14 Ga.	3" x 12 Ga.
4'1" to 6'	3" x 12 Ga.	3" x 12 Ga.
6'1" to 8'	3" x 12 Ga.	4" x 12 Ga.

Table 2 – Coating Performance Requirements		
<u>Quality Characteristics</u>	<u>ASTM Test Method</u>	<u>Performance Requirements</u>
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Montage Plus – Post Spacing By Bracket Type						
Span	For CLASSIC, GENESIS, MAJESTIC, & WARRIOR 8' Nominal (91.95" Rail)					
Post Size	2-1/2"	2-1/2"	2-1/2"	3"	2-1/2"	3"
Bracket Type	Montage Plus Universal (BB112)	Montage Plus Line Blvd. (BB114)	Montage Plus Flat Mount (BB111)		Montage Plus Swivel (BB113)*	
Post Settings ± 1/4" O.C.	95"	95"	95"	95-1/2"	*95"	*95-1/2"
*Note: When using BB113 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.						

END OF SECTION 323119

SECTION 21 13 13
FIRE SPRINKLER AND PIPING

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 piping and equipment for the following building systems:
 - 1. Automatic wet-type fire protection system comprising of 1 zones per floor compressed air type dry systems for any areas susceptible to freezing.
 - 2. Wet-pipe sprinklers, including piping, valves, specialties.
- B. Related Sections include the following:
 - 1. Division 22 05 29 Hangers and Supports.
 - 2. Division 23 21 16 Piping Specialties

1.3 DEFINITIONS

- A. Working Plans: Documents, including drawings, calculations, and material specifications prepared according to NFPA 13 and NFPA 14 for obtaining approval from authorities having jurisdiction.
- B. Authority having Jurisdiction: The building official, the City Fire Marshall and Engineer.

1.4 SYSTEM PERFORMANCE REQUIREMENTS

- A. Design standpipes and sprinklers and obtain approval from authorities having jurisdiction.
- B. Design & install fire protection system for canopies, drive-thru's, etc. requiring dry systems for freeze protection areas. Coordinate with G.C. and mechanical engineer for locations of loops drops and air compressor locations for maintenance.
- C. Design standpipes and obtain approval from authorities having jurisdiction. Include minimum residual pressures at hydraulically remote outlets according to the following.
 - 1. NPS 1-1/2 Hose Connections: 65 psig.
- D. Design sprinkler piping according to the following and obtain approval from authorities having jurisdiction.
 - 1. Office and Public Areas: Light Hazard.
 - 2. Restaurant Seating Areas: Light Hazard.
 - 3. Kitchen: Ordinary Hazard, Group 1.
 - 4. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - 5. Building Service Areas: Ordinary Hazard, Group 1.
- E. Design fire protection system and alarms using FM (Factory Mutual) Approved equipment, and design in accordance with FM (Factory Mutual) Property Loss Prevention Data.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Pipe and fitting materials and methods of joining for sprinkler and standpipe piping.
 - 2. Valves, including specialty valves, accessories, and devices.
 - 3. Alarm devices. Include electrical data.
 - 4. Hose connections. Include size, type and finish.
 - 5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish and other pertinent data.
- B. Fire-Hydrant Flow Test Report:
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction. Include hydraulic calculations, unless noted otherwise.
- D. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Materials and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."
- E. Maintenance Data: For each type of standpipe and sprinkler specialty to include in maintenance manuals specified in Division 1.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has designed and installed sprinkler piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction.
- B. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or Engineering Technician NICET Level III. Base calculations on results of fire-hydrant flow test or the Engineer's water analysis.
- C. Manufacturer Qualifications: Firms whose equipment, specialties, and accessories are listed by product name and manufacturer in UL's "Fire Protection Equipment Directory" and FM's "Figure Protection Approval Guide" and that comply with other requirements indicated.
- D. Standpipe and Sprinkler Components: Listing/approval stamp, label or other marking by a testing agency acceptable to authorities having jurisdiction.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- F. NFPA Standards: Equipment, specialties, accessories, installation and testing complying with the following:
 - 1. NFPA 13-96, "Installation of Sprinkler Systems."
 - 2. NFPA 14-96, "Standpipe and Hose Systems."
 - 3. NFPA 70-96, "National Electric Code."
 - 4. NFPA 72-96, "National Fire Alarm Code."
- G. International Conference of Building Code Officials codes and standards complying with the following:
 - 1. 2018 International Building Code
 - 2. 2018 International Fire Code

3. NFPA 13

1.7. EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: A supply of spare sprinklers (never less than 6) shall be supplied and located in a cabinet where the temperature does not exceed 100 F. These sprinklers shall correspond to the types and temperature rating of the sprinklers installed on the project. Special sprinkler head wrenches shall be included to correspond to the types of heads provided.

The stock of spare sprinklers shall include all types and ratings installed and shall be as follows:

- a. For systems with not over 300 sprinklers, not less than 6 sprinklers.
- b. For systems with 300 to 1000 sprinklers, not less than 12 sprinklers.
- c. For systems with over 1000 sprinklers, not less than 24 sprinklers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1. Specialty Valves and Devices:
 - a. Central Sprinkler Corp.
 - b. Firematic Sprinkler Devices, Inc.
 - c. Globe Fire Sprinkler Corp.
 - d. Grinnell Corp.
 - e. Reliable Automatic Sprinkler Co., Inc.
 - f. Viking Corp.
- 2. Water-Flow Indicators and Supervisory Switches:
 - a. Grinnell Corp.
 - b. Potter Electric Signal Co.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Viking Corp.
 - e. Watts Industries, Inc.; Water Products Div.
- 3. Sprinkler, Drain and Alarm Test Fittings:
 - a. Central Sprinkler Corp.
 - b. Grinnell Corp.
 - c. Victaulic Co. of America
- 4. Sprinkler, Branch-Line Test Fittings:
 - a. Smith Industries, Inc.; Potter-Roemer Div.
- 5. Sprinkler, Inspector's Test Fittings:
 - a. Grinnell Corp.
 - b. Central Sprinkler.
- 6. Sprinklers:
 - a. Central Sprinkler Corp., (except "Omega" type sprinklers).
 - b. Firematic Sprinkler Devices, Inc.
 - c. Globe Fire Sprinkler Corp.

- d. Grinnell Corp.
- e. Reliable Automatic Sprinkler Co., Inc.
- 7. Gate Valves:
 - a. American Cast Iron Pipe Co.; Waterous Co.
 - b. Grinnell Corp.
 - c. Nibco, Inc.
 - d. Stockham Valves & Fittings, Inc.
- 8. Indicator Valves:
 - a. Central Sprinkler, Inc.
 - b. Grinnell Corp.
 - c. Nibco, Inc.
 - d. Victaulic Co. of America.
- 9. Fire-Protection-Service Valves:
 - a. Central Sprinkler Corp.
 - b. Grinnell Corp.
 - c. Nibco, Inc.
 - d. Victaulic Co. of America
- 10. Keyed Couplings:
 - a. Grinnell Corp.
 - b. Victaulic Co. of America.
 - c. Central Sprinkler Corp.

2.2 PIPE AND TUBES

- A. Standard-Weight Steel Pipe: ASTM A 53, ASTM A 135, or ASTM A 795; Schedule 40 in NPS 6 and smaller, and Schedule 30 in NPS 8 and larger. Schedule 10 pipe for mains.

2.3 PIPE AND TUBE FITTINGS

- A. Cast-Iron Threaded Flanges: ASME B16.1.
- B. Cast-Iron Threaded Fittings: ASME B16.4.
- C. Steel, Threaded Couplings: ASTM A 865.
- D. Steel Welding Fittings: ASTM A 234/A 234M, ASME B16.9, or ASME B16.11.
- E. Steel Flanges and Flanged Fittings: ASME B16.5.
- F. Steel, Grooved-End Fittings: UL-listed and FM-approved, ASTM A 47, malleable iron or ASTM A 536, ductile iron; with dimensions matching steel pipe and ends factory grooved according to AWWA C606.

2.4 JOINING MATERIALS

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for pipe-flange gasket materials and welding filler metals.
- B. Steel, Keyed Couplings: UL 213 and AWWA C606, for steel-pipe dimensions. Include ASTM A 536, ductile-iron housing, rubber gaskets, and steel bolts and nuts. Include listing for dry-pipe service for coupling for dry piping.

2.5 GENERAL-DUTY VALVES

- A. Refer to Division 15 Section "Valves" for gate, ball, butterfly, globe, and check valves not required to be UL listed and FM approved.

2.6 FIRE-PROTECTION-SERVICE VALVES

- A. General: UL listed and FM approved, with minimum 175-psig nonshock working-pressure rating. Valves for grooved-end piping may be furnished with grooved ends instead of type of ends specified.
- B. Gate Valves, NPS 2 and Smaller: UL 262; cast-bronze, threaded ends, solid wedge; OS&Y; and rising stem.
- C. Indicating Valves, NPS 2-1/2 and Smaller: UL 1091; butterfly or ball-type bronze body with threaded ends; and integral indicating device.
 - 1. Indicator: Electrical prewired, supervisory switch. Coordinate voltage and number of circuits with Fire Alarm requirements.
- D. Gate Valves, NPS 2-1/2 and Larger: UL 262, iron body, bronze mounted, taper wedge, OS&Y, and rising stem. Include replaceable, bronze, wedge facing ranges and flanged ends.
- E. Swing Check Valves, NPS 2 and Smaller: UL 312 or MSS SP-80, Class 150; bronze body with bronze disc and threaded ends.
- F. Swing Check Valves, NPS 2-1/2 and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

2.7 SPECIALTY VALVES

- A. Alarm Check Valves: UL 193, 175-psig working pressure; designed for horizontal or vertical installation, with cast-iron flanged inlet and outlet, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
 - 1. Option: Grooved-end connections for use with keyed couplings.
 - 2. Drip Cup Assembly: Pipe drain without valves, and separate from main drain piping.

2.8 SPRINKLERS

- A. Automatic Sprinkler: With heat-responsive element complying with the following:
 - 1. NFPA 13, Current Edition
- B. Sprinkler Type and Categories: "Ordinary" temperature classification rating, unless otherwise indicated or required by application. Areas of light hazard occupancy shall be of the quick response type.
 - 1. Orifice: 1/2 inch with discharge coefficient K between 5.3 and 5.8.
 - 2. Orifice: 17/32 inch with discharge coefficient K between 7.4 and 8.2.
 - 3. Orifice: Extra large orifice allowed in Exhibition Hall.
- C. Sprinkler types, features, and options include the following:
 - 1. Concealed ceiling sprinklers, including cover plate painted to match existing sprinklers and ceiling.
 - 2. Extended-coverage sprinklers
 - 3. Pendent sprinklers.

4. Pendent, dry-type sprinklers.
 5. Quick-response sprinklers.
 6. Recessed sprinklers, including escutcheon to match existing sprinklers.
 7. Sidewall sprinklers.
 8. Sidewall, dry-type sprinklers.
 9. Upright sprinklers.
 10. Sprinklers located in canopies (dry system).
- D. Sprinkler Finishes: Chrome-plated black anodized, bronze, and painted.
- E. Special Coatings: Wax, lead, and corrosion-resistant paint.
- F. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

- A. General: Types matching piping and equipment connections.
- B. Water-Motor-Operated Alarms: UL 753, mechanical-operation type with pelton-wheel operator with shaft length, bearings and sleeve to suit wall construction and 10-inch- diameter, cast-aluminum alarm gong with red-enamel factory finish. Include NPS ¾ inlet and NPS 1 drain connections.
- C. Water-Flow Indicators: UL 346; electrical-supervision, vane-type water-flow detector, with 250-psig pressure rating; and designed for horizontal or vertical installation. Include two single-pole, double-throw, circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed. For wet system only.
- D. Pressure Switches: UL 753; electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts and design that operates on rising pressure and signals water flow. For dry system only.
- E. Valve Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
- F. Indicator-Post Supervisory Switches: UL 753; electrical; single-pole, double throw; with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.

2.10 PRESSURE GAGES

- A. Pressure Gages: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 250 psig.

2.11 COORDINATION

- A. All work of this contractor will be coordinated with other trades to insure minimal changes to the sprinkler system from the designs. Careful coordination of mechanical and electrical ducts, pipe and conduit shall be required.
- B. The ceiling areas must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing waste, rainwater, and soil lines; supply, return, and exhaust ductwork, water piping, fire protection piping. If fire protection piping is installed first and

conflicts arise with other trades due to lack of coordination, this contractor shall relocate fire sprinkler piping at no additional cost to the owner.

- C. All piping shall be run concealed where possible. All lines will be run as high as possible so as to not interfere with future changes to ceiling heights or other mechanical equipment. This contractor will be responsible for all sleeves, core drills, and sealing of penetrations in walls, floors and structural members to facilitate the installation of the system.

2.12 VALVE APPLICATIONS

- A. Indicate valve types to be used. The following requirements apply:
1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13 and NPFA 14.
 - a. Shutoff Duty: Use gate valves at building entry. Use butterfly valves at other locations.
 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.

2.13 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.
- C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for dielectric fittings.

2.14 SERVICE-ENTRANCE PIPING

- A. Connect standpipe and sprinkler piping to fire supply piping of size and in location indicated.

2.15 PIPING INSTALLATION

- A. Refer to Division 15 Section for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics and diagram indicate general location and arrangement of piping.
1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 15 Section.
- D. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

- E. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections grooved couplings may be used.
- G. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install drain valves on standpipes.
- J. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building. Install ball drips as needed on dry standpipe for drainage.
- K. Install alarm devices in piping systems.
- L. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping and to NFPA 14 for standpipes.
- M. Seismic Protection: Install piping according to NFPA 13 – see Section 15070.
- N. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated, or required by NFPA 13 for flexibility in seismic zones.
- O. Install pressure gages on riser. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

2.16 VALVE INSTALLATION

- A. Refer to Division 15 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.
- B. Gate Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Alarm Check Valves: Install valves in vertical or horizontal position for proper direction of flow, including bypass check valve and retard chamber drain-line connection. Install valve trim in accordance with the valve manufacturer's appropriate trim diagrams. Install main drain to exterior.
- D. Dry-Pipe Valves: Install trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment. Test valve for proper operation. Install main drain to exterior.
 - 1. Air-Pressure Maintenance Devices for Dry-Pipe Systems: Install shutoff valves to permit servicing without shutting down sprinkler system; bypass valve for quick system filling; pressure regulator or switch to maintain system pressure; strainer, pressure ratings with 14- to 60-psig adjustable range; and 175-psig maximum inlet pressure.

2. Install compressed-air supply piping from f.p.c. furnished compressed-air piping system.

2.17 SPRINKLER APPLICATIONS

- A. General: Sprinkler heads shall be of the latest design closed spray type of 165 F unless specified otherwise or required by code. Heads in light hazard of shall be quick response type. Heads shall be a minimum orifice size of $\frac{1}{2}$ ". Temperature rating of heads in elevator shafts shall be 286 F. Extra Large Orifice (ELO) heads shall not be used unless specified. Orifices larger than $\frac{1}{2}$ " may be used as required by density and spacing demands when specified. Use sprinklers according to the following applications:
 1. Rooms without Ceilings: Upright and/or pendent sprinklers. Provide mechanical guards on all heads at or below 7'-0" height above the floor or where damage from room occupant use may occur.
 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 3. Wall Mounting: Sidewall sprinklers with recessed escutcheon.
 4. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
 5. Provide freeze proof type automatic sprinkler heads serving loading dock, canopies, unconditioned spaces, areas subject to freezing and in other areas requiring their use.

2.18 SPRINKLER INSTALLATION

- A. Every effort shall be required to insure that the heads form a symmetrical pattern in the ceiling grid, lights, diffusers and grilles. Offsets shall be made in piping to accommodate ductwork in the ceiling. Heads should be symmetrical and all piping run parallel or perpendicular to building lines.
 1. In no case shall sprinkler heads be installed closer than approved distances from ceiling obstructions.
 2. Automatic sprinkler heads located in corridors shall be in center line of corridor.
- B. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers using compressed air dry system with water supply from heated space. See architectural plans for locations of all required areas.
- C. Install sprinkler in top and bottom of elevator shafts as required by code.
- D. Install sprinklers around smoke curtains at open stairwells as required by code.

2.19 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and NFPA 14 and in Section 15075 "Mechanical Identification."

2.20 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance.

- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

2.21 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

2.22 PROTECTION

- A. Protect sprinkler from damage until Substantial Completion.

2.23 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that air compressors and their accessories are installed and operate correctly.
- C. Verify that specified tests of piping are complete and that "Material Test Certificates" are complete.
- D. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- E. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- F. Drain dry-pipe sprinkler piping.
- G. Pressurize and check dry-pipe sprinkler piping air-pressure maintenance devices and air compressors.
- H. Fill wet-pipe sprinkler piping with water.
- I. Adjust operating controls and pressure settings.
- J. Coordinate with fire alarm tests. Operate as required.

2.24 DEMONSTRATION & TESTS

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. All tests will be conducted as required by the local authority having jurisdiction, and in no case less than those required by NFPA standards. As a minimum, piping in the sprinkler system shall be tested at a water pressure at 200 psi for a period of not less two hours, or at 50 psi. Bracing shall be in place, and air shall be removed from the system through the hydrants and drain valves before the test pressure is applied. No apparent leaks will be permitted on interior or underground piping.
- C. The local jurisdiction having authority shall be notified at least three working days in advance of all tests and flushing. This includes any flushing of undergrounds, hydrostatic testing, or flow testing that may be required.
- D. This contractor shall make all the required tests to the sprinkler system as required by code. He shall be responsible to assure that the Contractor Test Certificates for the

overhead and underground work are completed and delivered to the owner's insurance underwriter to assure proper insurance credit.

- E. All tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness, then they will be run later and all damage caused by the system, or caused in uncovering the system for such test, will be borne by this contractor.
- F. Trip test dry pipe sprinkler system as required by code and authority having jurisdiction.

2.25 WARRANTY

- A. This contractor shall warranty the sprinkler system and all its components for one year from the date of acceptance by the owner. Any costs incurred to extend any warranties of materials to assure this time frame shall be borne by this contractor.

END OF SECTION

SECTION 21 13 16
DRY-PIPE FIRE SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes dry-pipe sprinkler system, system design, installation, and certification.
- B. Related Sections:
 - 1. Section 22 05 48 - Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
 - 2. Section 22 05 53 - Mechanical Identification: Product requirements for Valve and piping identification for placement by this section.
 - 3. Wiring Connections: Execution requirements for electric connections to equipment specified by this section.

1.2 REFERENCES

- A. National Fire Protection Association:
 - 1. NFPA 13 - Installation of Sprinkler Systems.

1.3 SYSTEM DESCRIPTION

- A. System to provide coverage for canopies and any other areas susceptible to freezing.
- B. Provide hydraulically designed system to NFPA 13 ordinary hazard, Group 1 NFPA 13R occupancy requirements.
- C. Interface system with building fire and smoke alarm system.
- D. Provide fire department connections per code and/or as indicated on Drawings.

1.4 SUBMITTALS

- A. Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
- C. Product Data: Submit data on sprinklers, valves, compressors, and specialties, including manufacturer's catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- D. Design Data: Submit design calculations.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. See section Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 13 and local municipality.
- B. Maintain one copy of each document on site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years experience.
- C. Design system under direct supervision of Professional Engineer experienced in design of this Work and licensed in the state where the work is performed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01600 - Product Requirements: Product storage and handling requirements.
- B. Store products in shipping containers until installation.
- C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.9 WARRANTY

- A. Section 01700 - Execution Requirements: Product warranties and product bonds.
- B. Furnish one year manufacturer warranty for air compressor.

1.10 EXTRA MATERIALS

- A. Execution Requirements: Spare parts and maintenance products.
- B. Furnish extra sprinklers under provisions of NFPA 13.
- C. Furnish suitable wrenches for each sprinkler type.
- D. Furnish metal storage cabinet.

PART 2 PRODUCTS

2.1 SPRINKLERS

- A. Manufacturers:
 - 1. Automatic Sprinkler Corp. Model _____.
 - 2. Grinnell Corp. Model _____.
 - 3. Reliable Sprinkler Corp. Model _____.
- B. Suspended Ceiling Type:
 - 1. Type: Semi-recessed pendant type with matching clamp on escutcheon plate.
 - 2. Finish: Chrome plated.
 - 3. Escutcheon Plate Finish: Chrome plated.
 - 4. Fusible Link: Temperature rated for specific area hazard.
- C. Exposed Area Type:
 - 1. Type: Standard upright type with guard.
 - 2. Finish: Brass.
 - 3. Fusible Link: Fusible-solder link type temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler finish.

2.2 PIPING SPECIALTIES

- A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, with accelerator; with test and drain.
- B. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy red enameled gong and motor housing, nylon bearings, and inlet strainer.
- C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- D. Fire Department Connections:
 - 1. Type: Flush mounted wall type with chrome plated finish. Free standing type with ductile iron pedestal chrome plated.
 - 2. Outlets: Two way with thread size to suit fire department hardware; threaded dust cap and chain of matching material and finish.
 - 3. Drain: 3/4 inch (19 mm) automatic drip, outside.
 - 4. Label: "Sprinkler - Fire Department Connection"

2.3 AIR COMPRESSOR

- A. Manufacturers: As supplied & installed by F.P.C.
- B. Furnish materials in accordance with applicable state standards.
- C. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloading valve. Coordinate all electrical requirements with electrical contractor.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 13.
- B. Install Work in accordance with applicable state standards.
- C. Install buried shut-off valves in valve box. Install with post indicator.
- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.
- E. Install outside alarm-gong on building wall.
- F. Install piping to minimize obstruction with other work.
- G. Install piping in concealed spaces above finished ceilings.
- H. Center sprinklers in two directions in ceiling tile and install piping offsets. Dependent upon spacing and coordination with ceiling elements.
- I. Install guards on sprinklers.
- J. Install air compressor on vibration isolators. All sizing and installation to be by FPC. Refer to Section 22 05 48.
- K. Hydrostatically test entire system.
- L. Require test be witnessed by Authority having jurisdiction. Architect/Engineer.

3.2 INTERFACE WITH OTHER PRODUCTS

- A. Verify devices are installed and connected to fire alarm system.

3.3 CLEANING

- A. Execution Requirements: Final cleaning.
- B. Flush entire piping system of foreign matter.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Execution Requirements: Protecting installed construction.
- B. Apply masking tape or paper cover to sprinklers, cover plates, and sprinkler escutcheons not receiving field painted finish. Remove after painting.

3.5 SCHEDULES

END OF SECTION

SECTION 22 05 23
GENERAL DUTY VALVES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes valves for building services piping.

1.2 REFERENCES

- A. AGA Z21.22 (American Gas Association) - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.
- B. ASME B16.3 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.
- C. AWS (American Welding Society) - Welding and Brazing Qualifications.
- D. MSS SP-67 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Butterfly Valves.
- E. MSS SP-71 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- F. MSS SP-78 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Plug Valves, Flanged and Threaded Ends.
- G. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.
- H. MSS SP-85 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- I. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

- A. Submit product data in accordance with the General Conditions of the Contract.
- B. Product Data: Submit Manufacturers catalog information with valve data and ratings for each service.
- C. Welders Certificate: Include welders certification of compliance with ASME SEC IX., AWS D1.1.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.

PART 2 PRODUCTS

2.1 PLUMBING VALVES: all plumbing valves shall be rated for a minimum of 125% of system working pressure and temperature.

2.2 GATE VALVES

- A. Acceptable manufacturers:
 - 1. Bronze and Iron Body Valves: Jenkins, Powell, Stockham, Lunkenheimer, Milwaukee, Red-White, Walworth, Crane, Grinnell, Nibco.
 - 2. Ball Valves: James Bury, Worcester, Jenkins, Milwaukee, Apollo, Powell, Nibco.
 - 3. Butterfly Valves: Centerline, DeZurik, Fisher, Victaulic, Keystone, Grinnell, Flowseal.
 - 4. Gas Cock: Peter, Healy or Crane.
 - 5. Lubricated Plug Valves: Homestead, Nordstrom, Powell, Wallworth.
- B. Up To and Including **3 inches (80 mm)**: MSS SP-80, Class 125, bronze body, bronze trim, rising stem, hand-wheel, inside screw, solid wedge disc, solder or threaded ends.
- C. **2 inches (50 mm)** and Larger: MSS SP-70, Class 125, iron body, bronze trim, outside screw and yoke, hand-wheel, solid wedge disc, flanged ends. Furnish chain-wheel operators for valves **6 inches (150 mm)** and larger mounted over **8 feet (2400 mm)** above floor.

2.3 GLOBE VALVES

- A. Up To and Including **3 inches (80 mm)**: MSS SP-80, Class 125, bronze body, bronze trim, hand-wheel, bronze disc, solder or threaded ends.
- B. **2 inches (50 mm)** and Larger: MSS SP-85, Class 125, iron body, bronze trim, hand-wheel, outside screw and yoke, renewable bronze plug-type disc, renewable seat, flanged ends. Furnish chain-wheel operators for valves **6 inches (150 mm)** and larger mounted over **8 feet (2400 mm)** above floor.

2.4 BALL VALVES

- A. Construction, **4 inches (100 mm)** and Smaller: MSS SP-110, Class 150, **400 psi** CWP, bronze, two piece body, chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder or threaded ends.

2.5 PLUG VALVES

- A. Construction **2-1/2 inches (65 mm)** and Larger: MSS SP-78, **175 psi** CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Furnish lever operator with setscrew.

2.6 BUTTERFLY VALVES

- A. Construction 1-1/2 inches (40 mm) and Larger: MSS SP-67, 200 psi (1380 kPa) CWP, cast or ductile iron body. Nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, infinite position lever handle with memory stop. Furnish gear operators for valves 8 inches (150 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor.

2.7 SWING CHECK VALVES

- A. Up To and Including 3 inches (80 mm):
 - 1. MSS SP-80, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder or threaded ends.
- B. 2 inches (50 mm) and Larger:
 - 1. MSS SP-71, Class 12, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.8 SPRING LOADED CHECK VALVES

- A. Construction: Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

2.9 WATER PRESSURE REDUCING VALVES

- A. Up to 2 inches (50 mm):
 - 1. Construction: MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded ends.
- B. Over 2 inches (50 mm):
 - 1. Construction: MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.10 RELIEF VALVES

- 1. Construction: AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- 2. Construction: AGA Z21.22 certified, bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F (98.9 degrees C), capacity ASME SEC IV certified and labeled.

2.11 GATE VALVES

- A. Acceptable manufacturers:
 - 1. Bronze and Iron Body Valves: Jenkins, Powell, Stockham, Lunkenheimer, Milwaukee, Red-White, Walworth, Crane, Grinnell, Nibco.
 - 2. Ball Valves: James Bury, Worcester, Jenkins, Milwaukee, Apollo, Powell, Nibco.
 - 3. Butterfly Valves: Centerline, DeZurik, Fisher, Victaulic, Keystone, Grinnell, Flowseal.
 - 4. Gas Cock: Peter, Healy or Crane.
 - 5. Lubricated Plug Valves: Homestead, Nordstrom, Powell, Wallworth.

6. Construction: Bronze body, bronze trim, union bonnet, rising stem, hand-wheel, inside screw, solid wedge disc, solder or threaded ends.
- B. Over 2 inches (50 mm):
 1. Construction: Iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends.

2.12 GLOBE OR ANGLE VALVES

1. Construction: Bronze body, bronze trim, union bonnet, rising stem and hand-wheel, inside screw with renewable composition disc and bronze seat, solder or threaded ends.
- B. Over 2 inches (50 mm):
 1. Construction: Iron body, bronze trim, bolted bonnet, rising stem, hand-wheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.

2.13 BALL VALVES

1. Construction: Bronze, two piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends.

2.14 PLUG VALVES

1. Construction: Bronze body, bronze tapered plug, full port opening, non-lubricated, Teflon packing, threaded ends.
2. Operator: One plug valve wrench for every ten plug-valves with minimum of one wrench.
- B. Over 2 inches (50 mm):
 1. Construction: Cast iron body and plug, full port opening, pressure lubricated, teflon packing, flanged ends.
 2. Operator: Each plug valve with wrench with setscrew.

2.15 BUTTERFLY VALVES

- A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
- B. Disc: Aluminum bronze.
- C. Operator: Infinite position lever handle with memory stop.

2.16 SWING CHECK VALVES

1. Construction: Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.
- B. Over 2 inches (50 mm):
 1. Construction: Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

2.17 SPRING LOADED CHECK VALVES

- A. Construction: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.18 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe 2 inches (50 mm) and Under:
 - 1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
 - 2. Copper Pipe: Bronze, soldered joints.
- B. Flanges for Pipe Over 2 inches (50 mm):
 - 1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
 - 2. Copper Piping: Bronze.
- C. Gaskets: 1/16-inch (1.6 mm) thick preformed neoprene.
- D. Grooved and Shouldered Pipe End Couplings:
 - 1. Housing Clamps: Malleable iron to engage and lock designed to permit some angular deflection, contraction, and expansion.
 - 2. Sealing Gasket: C-shape elastomer composition for operating temperature range from 30 degrees F to 230 degrees F.
- E. Accessories: Steel bolts, nuts, and washers.
- F. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.19 TEMPERATURE-ACTUATED WATER MIXING VALVES

- A. Individual-Fixture, Water Tempering:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Powers; a Watts Industries Co.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1070, thermostatically controlled water tempering valve.
 - 3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
 - 4. Body: Bronze body with corrosion-resistant interior components.
 - 5. Temperature Control: Adjustable.
 - 6. Inlets and Outlet: Threaded.
 - 7. Finish: Rough or chrome-plated bronze.
- B. TMV-1 Thermostatic Mixing Valve: Leonard TM-80 thermostatic mixing valve with 1" inlets, 1-1/4" outlet, cold water bypass with volume control/shutoff and cabinet.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify Piping System is ready for installation.

3.2 INSTALLATION

- A. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- B. Install valves with stems upright or horizontal, not inverted.
- C. Use grooved mechanical couplings and fasteners only in accessible locations.
- D. Install unions downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- E. Install ball or butterfly valves for shut-off and to isolate each piece of equipment, part of systems, or vertical risers.
- F. Install globe, ball or butterfly valves for throttling, bypass, or manual flow control services.
- G. Provide spring loaded check valves on discharge of water pumps.
- H. Provide plug valves in natural gas systems for shut-off service.
- I. Provide flow controls in water re-circulating systems as indicated on Drawings.
- J. Use lug end butterfly valves to isolate equipment.
- K. Use **3/4 inch (20 mm)** ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.
- L. Provide check valve for backflow prevention.
- M. Provide access means for each valve. Coordinate access means with General Contractor.
- N. Provide isolation valve at each branch take-off serving two or more fixtures or items of equipment.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Conform to applicable piping specification for hangers and insulation.

END OF SECTION

**SECTION 22 05 29
HANGERS AND SUPPORTS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe and equipment supports, hangers, anchors, bases sleeves and sealing of work to adjacent construction.

1.2 REFERENCES

- A. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- B. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- C. AWS D1.1 (American Welding Society) - Structural Welding Code.
- D. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- E. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.
- F. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with AWS D1.1 for welding hanger and support attachments to building structure.

1.4 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers:
 - 1. B-Line, Fee and Mason, Grinnell, PH.D and Michigan
- B. General:
 - 1. Hangers, and accessories shall be sized with a safety factor of five (5) times the actual load.
 - 2. Hangers for insulated piping shall be oversized to accommodate insulation thickness. Provide with insulation shields with inserts or insulation saddles as required in Section 220700 – Mechanical Insulation.
 - 3. Copper clad hangers shall be used for copper piping systems. Provide heavy density mildew and moisture rot proof felt pad securely attached to the hanger or

5 mil thick polyvinyl chloride coating to prevent contact between the pipe and hanger.

- C. Plumbing Piping – DWV:
1. Conform to ASME B31.9 ASTM F708 MSS SP58 MSS SP69 MSS SP89.
 2. Hangers for Pipe Sizes **1/2 to 1-1/2 inch (13 to 38 mm)**: Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes **2 inches (50 mm)** and Over: Hot Dipped Galvanized, Carbon steel, adjustable, clevis.
 4. Multiple or Trapeze Hangers: Hot dipped galvanized, steel channels with welded spacers and hanger rods.
 5. Wall Support for Pipe Sizes to **3 inches (76 mm)**: Cast iron hook.
 6. Wall Support for Pipe Sizes **4 inches (100 mm)** and Over: Welded hot dipped galvanized steel bracket and wrought hot dipped galvanized steel clamp.
 7. Vertical Support: Hot dipped galvanized steel riser clamp.
 8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 9. Copper Pipe Support: Copper-plated, Carbon-steel adjustable, ring.
- D. Plumbing Piping – Water:
1. Conform to ASME B31.9 ASTM F708 MSS SP 58 MSS SP69 MSS SP89.
 2. Hangers Pipe Sizes $\frac{1}{2}$ to 1-1/2 inch (13 to 38 mm): Hot dipped galvanized, carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes 2 inches (50 mm) and Over: Hot dipped galvanized, carbon steel, adjustable, clevis.
 4. Hangers for Hot Pipe Sizes 2 to 4 inches (50 to 100 mm): Hot dipped galvanized, carbon steel, adjustable, clevis.
 5. Hangers for Hot Pipe Sizes 6 inches (150 mm) and Over: Adjustable, Hot dipped galvanized, steel yoke, cast iron roll, double hanger.
 6. Multiple or Trapeze Hangers: Hot dipped galvanized, steel channels with welded spacers and hanger rods.
 7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches (150 mm) and Over: Hot dipped galvanized, steel channels with welded spacers and hanger rods, cast iron roll.
 8. Wall support for pipe sizes to 3 inches (76 mm): Cast iron hook.
 9. Wall support for pipe sizes 4 inches (100 mm) and Over: Welded, hot dipped galvanized, steel bracket and wrought hot dipped galvanized steel clamp.
 10. Wall support for hot pipe sizes 6 inches (150 mm) and Over: Welded hot dipped galvanized, steel bracket and wrought hot dipped galvanized, steel clamp with adjustable steel yoke and cast iron roll.
 11. Vertical Support: Hot dipped galvanized, steel riser clamp.
 12. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 13. Floor support for hot pipe sizes to 4 inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
 14. Floor support for hot pipe sizes 6 inches (150 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or hot dipped galvanized steel support.
 15. Copper Pipe Support: Copper-plated, Hot Dipped Galvanized, Carbon-steel ring.
- E. Hydronic Piping:
1. Conform to ASME B31.9 ASTM F708 MSS SP58 MSS SP69 MSS SP89.
 2. Hangers for Pipe Sizes **1/2 to 1-1/2 inch (13 to 38 mm)**: Hot Dipped Galvanized, Carbon steel, adjustable swivel, split ring.
 3. Hangers for Cold Pipe Sizes **2 inches (50 mm)** and Over: Hot Dipped Galvanized, Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes **2 to 4 inches (50 to 100 mm)**: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes **6 inches (150 mm)** and Over: Adjustable, Hot dipped galvanized, steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Hot dipped galvanized, steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes **6 inches (150 mm)** and Over: Hot dipped galvanized, steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to **3 inches (76 mm)**: Cast iron hooks.
9. Wall Support for Pipe Sizes **4 inches (100 mm)** and Over: Welded, hot dipped galvanized, steel bracket and wrought hot dipped galvanized steel clamp.
10. Wall Support for Hot Pipe Sizes **6 inches (150 mm)** and Over: Welded, hot dipped galvanized steel bracket and wrought, hot dipped galvanized, steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Hot dipped galvanized steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or hot dipped galvanized steel support.
13. Floor Support for Hot Pipe Sizes to **4 Inches (100 mm)**: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or hot dipped galvanized steel support.
14. Floor Support for Hot Pipe Sizes **6 inches (150 mm)** and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or hot dipped galvanized steel support.
15. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 ACCESSORIES

- A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

- A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

- A. Metal Flashing: **26 gage** galvanized steel.
- B. Metal Counterflashing: **22 gage** galvanized steel.
- C. Lead Flashing:
 1. Waterproofing: **5 lb./sq. ft (24.5 kg/sq m)** sheet lead
 2. Soundproofing: **1 lb./sq. ft (5 kg/sq m)** sheet lead.
- D. Flexible Flashing: **47 mil thick** sheet butyl; compatible with roofing.
- E. Caps: Steel, **22 gage (0.8 mm)** minimum; **16 gage (1.5 mm)** at fire resistant elements.

2.5 EQUIPMENT CURBS

- A. Fabrication: Welded 18 gage (1.2 mm) galvanized steel shell and base, mitered 3 inch cant, variable step to match roof insulation, 1-1/2 inch thick insulation, factory installed wood nailer.

2.6 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage (1.2 mm) thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.
- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed Sleeves for Round Ductwork: Galvanized steel.
- D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
- E. Fire-Stopping Insulation: Glass fiber type, non-combustible.

PART 3 EXECUTION

3.1 INSTALLATION

3.2 INSERTS

- A. Install inserts for placement in concrete forms.
- B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers with minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.

- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.

3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide reinforced concrete housekeeping pads, minimum 4 thick and extending **6 inches (150 mm)** beyond supported equipment. Refer to Architectural Concrete Specifications.
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of Steel pipe and fittings. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.5 FLASHING

- A. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.
- B. Flash vent and soil pipes projecting **3 inches (75 mm)** minimum above finished roof surface with lead worked **1 inch (25 mm)** minimum into hub, **8 inches (200 mm)** minimum clear on sides with **24 x 24 inches (600 x 600 mm)** sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.
- C. Flash floor drains in floors with topping over finished areas with lead, **10 inches (250 mm)** clear on sides with minimum **36 x 36 inch (910 x 910 mm)** sheet size. Fasten flashing to drain clamp device.
- D. Seal floor drains watertight to adjacent materials.
- E. Provide acoustical sound control around ducts and pipes penetrating equipment rooms. Fill openings with fiberglass blanket and caulk each side of opening with non-hardening caulking compound.
- F. Provide curbs for mechanical roof installations **14 inches** minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.
- G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 SLEEVES

- A. Set sleeves in position in forms. Provide reinforcing around sleeves.

- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors **1 inch** above finished floor level. Caulk sleeves.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

- A. Install pipe hangers in accordance to IPC Section 308.

END OF SECTION

SECTION 22 05 48
MECHANICAL SOUND, VIBRATION, AND SEISMIC CONTROL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes vibration isolation. Seismic anchorage for all isolated and non-isolated equipment, ductwork and piping systems furnished and installed under Division 15.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports
 - 2. Section 232116 – Piping Specialties: Product requirements for Supports, anchors and piping expansion compensation for placement by this section.
 - 3. Section 233100 – Ducts
 - 4. Section 233300 – Duct Accessories: Product requirements for both solid and flexible duct connectors for duct silencers specified for placement by this section.

1.2 PERFORMANCE REQUIREMENTS

- A. Mechanical Contractor is to provide seismic anchorage and bracing for all equipment, ductwork and piping in accordance with the appropriate seismic zone of the 2018 International Building Code.
 - 1. Where required, Supports, anchorage and bracing of all equipment, piping and ductwork, shall be designed by a professional structural engineer with qualified w experience in the seismic bracing of mechanical systems. The seismic engineer shall establish anchorage requirement specific to the equipment submitted, reviewed and accepted by the Architect/Engineer for the project.
 - 2. Furnished equipment shall meet the requirements of the seismic codes with bases and supports designed to accommodate seismic support.
 - 3. Prior to starting mechanical work, mechanical contractor is to submit to mechanical engineer and to the authority having jurisdiction, seismic details and drawings by a licensed seismic engineer for all equipment requiring seismic restraint. These drawings are to be stamped and signed, and will then be reviewed with engineer and city.
 - 4. Upon completion of the project, the licensing seismic engineer shall perform a walk through of the project site and submit a written observation report to the mechanical engineer and to the city. Contractor shall notify engineer and the city when seismic engineer is to perform site visit.
- B. Provide vibration isolation on motor driven equipment over 0.5 hp (0.35 kW), plus connected piping and ductwork.
- C. Provide minimum static deflection of isolators for equipment as follows:
 - 1. Slab on Grade, Under 20 hp (15 kW)
 - a. Under 400 rpm: Rubber Floor Isolator or Hanger
 - b. 400 – 600 rpm: 1 inch (25 mm)
 - c. 600 - 800 rpm: 0.5 inch (12 mm)
 - d. 800 - 900 rpm: 0.2 inch (5 mm)
 - e. 1100 - 1500 rpm: 0.14 inch (4 mm)
 - f. Over 1500 rpm: 0.1 inch (3 mm)

2. Slab on Grade, Over 20 hp (15 kW)
 - a. Under 400 rpm: Rubber Floor Isolators or Hangers
 - b. 400 - 600 rpm: 2 inch (50 mm)
 - c. 600 - 800 rpm: 1 inch (25 mm)
 - d. 800 - 900 rpm: 0.5 inch (12 mm)
 - e. 1100 - 1500 rpm: 0.2 inch (5 mm)
 - f. Over 1500 rpm: 0.15 inch (4 mm)
 3. Upper Floors, Normal
 - a. Under 400 rpm: Rubber Floor Isolators or Hangers
 - b. 400 - 600 rpm: 3.5 inch (90 mm)
 - c. 600 - 800 rpm: 2 inch (50 mm)
 - d. 800 - 900 rpm: 1 inch (25 mm)
 - e. 1100 - 1500 rpm: 0.5 inch (12 mm)
 - f. Over 1500 rpm: 0.2 inch (5 mm)
- D. Maintain sound level of spaces at levels not to exceed those listed below by utilizing acoustical devices.
- E. Maintain rooms at 35 NC maximum sound levels, in Noise Criteria (NC) as defined by ASHRAE Handbook.

1.3 SUBMITTALS

- A. Submit shop drawings calculations and product data in accordance with the general provisions of the specifications.
- B. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each. Indicate assembly, materials, thickness, dimensional data, pressure losses, acoustical performance, layout, and connection details for sound attenuation products fabricated for this project.
- C. Product Data: Submit schedule of vibration isolator type with location and load on each. Submit catalog information indicating, materials and dimensional data.
- D. Design Data: Submit calculations for seismic and vibration requirements for all equipment to be restrained and isolated. Drawings and calculations submitted for seismic bracing and anchors shall bear the engineer's signed professional seal.
- E. Prior to starting mechanical work, contractor is to submit to mechanical engineer seismic details and drawings by a licensed seismic engineer for all equipment requiring seismic restraint. These drawings are to be stamped and signed, and will then be reviewed with engineer and city.
- F. Upon completion of the project, mechanical contractor is to have the licensing seismic engineer perform a walk through of the project site and submit a written observation report to the mechanical engineer and to the city. Contractor shall notify engineer and the city when seismic engineer is to perform site visit.
- G. Manufacturer's Installation Instructions: Submit special procedures and setting dimensions. Indicate installation requirements maintaining integrity of sound isolation.
- H. Manufacturer's Certificate: Certify isolators meet or exceed specified requirements.
- I. Manufacturer's Field Reports: Indicate sound isolation and seismic restraint installation is complete and in accordance with instructions.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with International Building Code (IBC), Smacna Seismic Restraint Manual, AMCA 300 ANSI S1.13 ARI 575 ASA 16 ANSI S1.36 standards and recommendations of ASHRAE 68.
- B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [documented] experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.
- C. Design application of seismic restraint systems under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Utah.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Open Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch (1.2 mm); meet requirements for neoprene pad isolators.
- B. Restrained Spring Isolators:
 - 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 - 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 - 3. Spring Mounts: Furnish with leveling devices, minimum 0.25 inch (6 mm) thick neoprene sound pads, and zinc chromate plated hardware.
 - 4. Sound Pads: Size for minimum deflection of 0.05 inch (1.2 mm); meet requirements for neoprene pad isolators.
 - 5. Restraint: Furnish mounting frame and limit stops.
- C. Closed Spring Isolators:
 - 1. Spring Isolators:

- a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch (7 mm) clearance.
- D. Restrained Closed Spring Isolators:
 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Type: Closed spring mount with top and bottom housing separated with neoprene rubber stabilizers.
 3. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 4. Housings: Incorporate neoprene isolation pad meeting requirements for neoprene pad isolators, and neoprene side stabilizers with minimum 0.25 inch (7 mm) clearance and limit stops.
- E. Spring Hanger:
 1. Spring Isolators:
 - a. For Exterior and Humid Areas: Furnish hot dipped galvanized housings and neoprene coated springs.
 - b. Code: Color code springs for load carrying capacity.
 2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
 3. Housings: Incorporate rubber hanger with threaded insert.
 4. Misalignment: Capable of 20 degree hanger rod misalignment.
- F. Neoprene Pad Isolators:
 1. Rubber or neoprene-waffle pads.
 - a. 30 durometer.
 - b. Minimum 1/2 inch (13 mm) thick.
 - c. Maximum loading 40 psi (275 kPa).
 - d. Height of ribs: not to exceed 0.7 times width.
 2. Configuration: 1/2-inch (13 mm) thick waffle pads bonded each side of 1/4-inch (6 mm) thick steel plate.
- G. Rubber Mount or Hanger: Molded rubber designed for 0.5 inches (13 mm) deflection with threaded insert.
- H. Glass Fiber Pads: Neoprene jacketed pre-compressed molded glass fiber.
- I. Seismic Snubbers:
 1. Type: Non-directional and double acting unit consisting of interlocking steel members restrained by neoprene elements.
 2. Neoprene Elements: Replaceable, minimum of 0.75 inch (18 mm) thick.
 3. Capacity: 4 times load assigned to mount groupings at 0.4 inch (10 mm) deflection.

4. Attachment Points and Fasteners: Capable of withstanding 3 times rated load capacity of seismic snubber.

PART 3 EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION

- A. Install isolation for motor driven equipment.
 1. Bases:
 2. Set steel bases for 1-inch (25 mm) clearance between housekeeping pad and base.
 3. Set concrete inertia bases for 2-inch (50 mm) clearance between housekeeping pad and base.
 4. Adjust equipment level.
- B. Install spring hangers without binding.
- C. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- D. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- E. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Provide each inertia base with minimum of four seismic snubbers located close to isolators. Snub equipment designated for post disaster use to 0.05-inch (1.5 mm) maximum clearance. Provide other snubbers with clearance between 0.15 inch (4 mm) and 0.25 inch (7 mm).
- F. Support piping connections to isolated equipment resiliently as follows:
 1. Up to 4 inch (100 mm) Diameter: First three points of support.
 2. 5 to 8 inch (125 to 200 mm) Diameter: First four points of support.
 3. 10 inch (250 mm) Diameter and Over: First six points of support.
 4. Select three hangers closest to vibration source for minimum 1.0-inch (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0-inch (25 mm) static deflection or 1/2 static deflection of isolated equipment.
- G. Connect wiring to isolated equipment with flexible hanging loop.

3.3 FIELD QUALITY CONTROL

- A. Quality Requirements: Testing, adjusting, and balancing.
- B. Inspect isolated equipment after installation and submit report. Include static deflections.
- C. After start-up, final corrections and balancing of systems take octave band sound measurements over full audio frequency range in areas adjacent to mechanical equipment rooms, duct and pipe shafts, and other critical locations. Provide one-third octave band measurements of artificial sound sources in areas indicated as having critical requirements. Submit complete report of test results including sound curves.

PIPE ISOLATION SCHEDULE

Pipe Size Inch (mm)	Isolated Distance from Equipment
1 (25)	120 diameters (3.0 m)
2 (50)	90 diameters (4.5 m)
3 (80)	80 diameters (6.0 m)
4 (100)	75 diameters (7.5 m)
6 (150)	60 diameters (9.0 m)
8 (200)	60 diameters (12.0 m)
10 (250)	54 diameters (13.5 m)
12 (300)	50 diameters (15.0 m)
16 (400)	45 diameters (18.0 m)
24 (600)	38 diameters (23.0 m)
Over 24 (600)	

EQUIPMENT ISOLATION SCHEDULE

ISOLATED EQUIPMENT	BASE TYPE	ISOLATOR TYPE
	THICKNESS	DEFLECTION
HVAC Pumps	B/C	2/3
Chillers	A	2
Fans (over 10 H.P.)	C	4

BASE TYPES:

- A = No base, isolators attached directly to equipment
- B = Structural steel rails or base
- C = Concrete inertia base
- D = Curb-mounted base

ISOLATOR TYPES:

- 1 = Rubber or glass fiber pad
- 2 = Rubber floor isolator or hanger
- 3 = Spring floor isolator or hanger
- 4 = Restrained spring isolator
- 5 = Thrust restraint
- 6 = Spring and rubber in series hanger

NOTES:

1. Contractor shall provide vibration isolation and calculations stamped by a licensed professional engineer.
2. To avoid isolator resonance problems, select isolator deflection so that natural frequency is 40% or less than lowest operating speed of equipment (see ASHRAE HVAC applications handbook).

END OF SECTION

SECTION 22 05 53
MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes nameplates, tags, stencils and pipe markers.

1.2 REFERENCES

- A. ASME A13.1 (American Society of Mechanical Engineers) - Scheme for the Identification of Piping Systems.
- B. NFPA 99 (National Fire Protection Association) - Standard for Health Care Facilities.

1.3 SUBMITTALS

- A. Submit product data and shop drawings in accordance with the General Conditions of the Contract.
- B. Product Data: Submit manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description: Laminated three-layer plastic with engraved letters in contrasting background color.

2.2 TAGS

- 1. Brass with stamped letters; tag size minimum 1-1/2 inches diameter with finished edges. Provide with brass chains for installation.
- B. Information Tags:
 - 1. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
- C. Tag Chart: Typewritten letter size list of applied tags and location plastic laminated.

2.3 STENCILS

- A. Stencils: With clean cut symbols and letters of following size:
 - 1. Up to 1 1/4 inches Outside Diameter of Insulation or Pipe: 1/2 inch-high letters.
 - 2. 1-1/2 to 2 inches outside diameter of insulation of pipe: 3/4 inch high letters.
 - 3. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 1/4-inch high letters.
 - 4. Outside Diameter of Insulation or Pipe: 2 1/2 inches high letters.
 - 5. Over 10 inches outside diameter of pipe or insulation: 3-1/2 inch high letters.
 - 6. Ductwork and Equipment: 2-1/2 inches high letters.
- B. Stencil Paint: As specified in Architectural Painting Specifications, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
 - 1. Manufacturer:
 - a. Set mark type snap-around markers.
 - 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Tape Pipe Markers:
 - 1. Manufacturer:
 - a. Brady Type 350.
 - 2. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings, with legend, size and color coding.

2.5 CEILING TACKS

- A. Description: Steel with **3/4 inch (19 mm)** diameter color-coded head.
- B. Color code as follows:
 - 1. HVAC equipment: Yellow.
 - 2. Fire dampers/smoke dampers: Red.
 - 3. Plumbing valves: Green.
 - 4. Heating/cooling valves: Blue.

2.6 LABELS

- A. Description: Laminated Mylar, size **1.9 x 0.75 inches**, adhesive backed with printed identification.

PART 3 EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Architectural Painting Specifications for stencil painting.

3.2 INSTALLATION

- A. Apply stencil painting in accordance with Architectural Painting Specifications.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.

- F. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Identify in-line pumps and other small devices with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with tags.
- I. Identify air terminal units and radiator valves with numbered tags.
- J. Tag automatic controls, instruments, and relays. Key to control schematic.
- K. Identify piping, concealed or exposed, with plastic pipe markers, plastic tape pipe markers or stenciled painting. Use tags on piping $\frac{3}{4}$ inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- L. Provide ceiling tacks to locate valves or dampers above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

3.3 SCHEDULES

IDENTIFICATION

- 1. Domestic Cold Water Piping.
 - a. Background Color: Green
- 2. Domestic Hot Water.
 - a. Background Color: Yellow
- 3. Hot water Heating.
 - a. Background Color: Yellow
 - b. With Directional Arrow.
- 4. Natural Gas.
 - a. Background Color: Orange
- 5. Ductwork.
 - a. Identification Type: N/A
- 6. Chilled Water
 - a. Background Color: Blue
 - b. With Directional Arrow.
- 7. Cooling Tower
 - a. Background Color: Light Green
 - b. With Directional Arrow.

END OF SECTION

**SECTION 22 07 00
MECHANICAL INSULATION**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes ductwork insulation, duct liner, insulation jackets, covering, and thermal insulation for piping systems including vapor retarders, jackets and accessories.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports: Execution requirements for inserts for placement by this section.
 - 2. Section 220523 – Mechanical Identification: Product requirements for mechanical identification for placement by this section.

1.2 REFERENCES

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- C. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- D. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- F. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- G. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.
- H. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
- I. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- J. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
- K. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type).
- L. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation.
- M. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

- N. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- O. ASTM C1126- Standard Specification for Preformed Closed Cell Phenolic Foam Pipe and Board Insulation.
- P. ASTM C1136 – Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
- Q. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
- R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- S. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- T. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- U. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- V. NAIMA (North American Insulation Manufacturers Association) - National Insulation Standards.
- W. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.

1.3 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location, as per the general conditions of the contract.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Applicator: Company specializing in performing Work of this section with minimum three years experience.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Certain-Teed
Owens-Corning
Johns-Manville
Armstrong
Knauf
Dow Chemical

2.2 GLASS MINERAL FIBER, FLEXIBLE BLANKET DUCT WRAP

- A. Insulation: Glass Fiber Blanket Thermal Insulation for Commercial and Industrial Applications. Supply & return air ducts are to be insulated with a minimum of R-6 insulation installed.
- B. Vapor Retarder Jacket: ASTM 1136, Type II Flexible and Low Permeance Vapor Retarders for Thermal Insulation. Perm rating shall not exceed .24 when tested in accordance with ASTM E96, Procedure A.
- C. Manufacturers:
 - 1. Manufacturers:
 - Certain-Teed
 - Owens-Corning
 - Johns-Manville
 - Armstrong
 - Knauf
 - Dow Chemical
 - 2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

- D. Indoor Vapor Retarder Finish:
1. Manufacturers:

Certain-Teed

Owens-Corning

Johns-Manville

Armstrong

Knauf

Dow Chemical

2.3 CELLULAR GLASS PIPE INSULATION

- A. Insulation: ASTM C552, Type II – pipe and tubing insulation, Class 2 - Jacketed.
1. 'K' ('ksi') factor: ASTM C177 or ASTM C518, 0.25at 75 degrees F.
- B. Vapor retarder jacket: Perm rating shall not exceed 0.25 when tested in accordance with ASTM E96, Procedure A.

2.4 PROTECTIVE INSULATION JACKET (PIPE INSULATION EXPOSED TO WEATHER)

- A. Aluminum Jacket: ASTM B209.
1. Thickness: 0.016 inch thick sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

2.5 GLASS FIBER DUCT LINER, FLEXIBLE Insulation for Interior of sheet metal ducts.

- A. Insulation: ASTM C1071 Thermal and Acoustical Insulation Glass Fiber, Duct Lining Material, Type I
- B. Adhesive:
1. Waterproof, ASTM E162 fire-retardant type.
- C. Liner Fasteners: Galvanized steel, welded with integral head.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping, equipment and ductwork has been tested before applying insulation materials.
- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

- A. Install in accordance with NAIMA National Insulation Standards.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. For hot piping conveying fluids over **110 degrees F**, insulate flanges and unions at equipment.
- D. Glass fiber insulated pipes conveying fluids above ambient temperature:
 - 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- E. Inserts and Shields:
 - 1. Application: Piping or Equipment **1-1/2 inches** diameter or larger.
 - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 - 3. Insert location: Between support shield and piping and under finish jacket.
 - 4. Insert configuration: Minimum **6 inches (150 mm)** long, of thickness and contour matching adjoining insulation; may be factory fabricated.
 - 5. Insert material: Compression resistant insulating material suitable for planned temperature range and service.
- F. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07840 for penetrations of assemblies with fire resistance rating greater than one hour.
- G. Exterior Applications: Provide vapor retarder jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with stainless steel jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal equipment.
- H. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- I. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.
- J. Glass fiber insulated equipment containing fluids above ambient temperature: Provide standard jackets, with or without vapor retarder, factory-applied or field-applied. Finish with glass cloth and adhesive.
- K. Finish insulation at supports, protrusions, and interruptions.
- L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.
- N. Insulated ductwork conveying air below ambient temperature:

1. Provide insulation with vapor retarder jackets.
 2. Finish with tape and vapor retarder jacket.
 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- O. Duct Liner Application:
1. Adhere insulation with adhesive for 100 percent coverage.
 2. Secure insulation with mechanical liner fasteners. SMACNA Standards for spacing.
 3. Seal and smooth joints. Seal and coat transverse joints.
 4. Seal liner surface penetrations with adhesive.
 5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.
- P. On cold & hot water piping that feeds exterior hose bibs & sill cocks, insulate entire pipe all the way to the fixture for freeze protection.
- Q. Install PVC jacket on the interior exposed insulation in the mechanical boiler room and in the mechanical penthouse.
- R. All chilled water and heating water storage tanks are to be insulated with 2" fiberglass insulation cloth coated and sewn with tight seal.

3.3 SCHEDULES

- A. Plumbing Systems:
1. Domestic & Industrial Hot Water Supply and Recirculation Systems:
 - a. Insulate entire system with fiberglass pipe covering with all service jacket and self seal lap. Insulation thickness as follows: 1" thick for all pipe sizes.
 2. Domestic & Industrial Cold Water:
 - a. Horizontal mains and elbows to vertical risers / drops: ½" thick fiberglass pipe covering with all service jacket and self-seal lap.
 3. Primary Roof Drains:
 - a. Horizontal mains and vertical to and including drain bowls with ½ inch thick fiberglass pipe covering with all service jacket and self-seal lap.
 - b. Bowls of secondary roof drains shall be insulated with ½ " thick foil scrim face.
 4. Fittings:
 - a. Pre-molded PVC fitting covers with fiberglass insert. In return air plenums use insulating cement finished with 6-ounce canvas and heavy coat of vapor barrier mastic coating.
- B. Refrigerant Piping
1. Fiberglass pipe covering with all-service jacket and self-seal lap.
 2. Thickness as follows: 0.75" thick for pipe sizes up to and including 1½". 0.75" thick for pipes sizes 2" and larger.
- C. Air Distribution System:
1. Downstream of the fan coil units, the duct is to be lined if rectangular and wrapped if round. In exposed ceiling areas, no insulation is required. All return air grilles shall have lined sound boots painted flat black

2. Supply ductwork (not indicated to be lined): 1½" thick .75 pound fiberglass duct wrap with foil scrim facing. Seal all joints. Apply with adhesive or wire at 18" O.C.
 3. Lined supply ductwork.
 - a. Insulate with 1" duct liner with continuous sheet metal edge protector at entering and leaving edges.
 - b. Coat transverse joints prior to installation.
 - c. Line ductwork in rectangular ductwork downstream of DOAS units and upstream of toilet exhaust fans a minimum distance of 10'-0" or , transfer air ducts and supply plenums above air devices.
 - d. Pipe insulation exposed to weather.
- D. Provide aluminum jacket and fitting covers on all piping exposed to weather

END OF SECTION

SECTION 22 11 00
DOMESTIC WATER PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes domestic & industrial water piping, valves, fittings, hangers, pumps, water softeners, controls and accessories.
- B. Related Sections:
 - 1. Section 220529: Hangers and Supports.
 - 2. Section 220548 – Mechanical Sound, Vibration, and Seismic Control: Product requirements for vibration isolators for placement by this section.
 - 3. Section 220700 – Mechanical Identification: Product requirements for pipe identification and valve tags for placement by this section.

1.2 REFERENCES

- A. ASME B16.1 (American Society of Mechanical Engineers) - Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250 and 800.
- B. ASME B16.18 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Pressure Fittings.
- C. ASME B16.22 (American Society of Mechanical Engineers) - Wrought Copper and Bronze Solder Joint Pressure Fittings.
- D. ASME B16.26 (American Society of Mechanical Engineers) - Cast Bronze Fittings for Flared Copper Tubes.
- E. ASME B31.9 (American Society of Mechanical Engineers) - Building Service Piping.
- F. ASTM B32 - Solder Metal.
- G. ASTM B42 - Seamless Copper Pipe.
- H. ASTM B88 - Seamless Copper Water Tube (ASTM B88M - Seamless Copper Water Tube [Metric]).
- I. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- J. AWS A5.8 (American Welding Society) - Brazing Filler Metal.
- K. AWWA C651 (American Water Works Association) - Disinfecting Water Mains.
- L. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- M. MSS SP-67 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Butterfly Valves.
- N. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.

- O. MSS SP-70 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Gate Valves, Flanged and Threaded Ends.
- P. MSS SP-71 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
- Q. MSS SP-78 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Plug Valves, Flanged and Threaded Ends.
- R. MSS SP-80 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Bronze Gate, Globe, Angle and Check Valves.
- S. MSS SP-85 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends.
- T. MSS SP-89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.
- U. MSS SP-110 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- V. UL 1479 (National Fire Protection Association) - Fire Tests of Through-Penetration Firestops.
- W. ASME A1126.1 (American Society of Mechanical Engineers) - Water Hammer Arrestors.
- X. ASSE 1011 (American Society of Sanitary Engineering) - Hose Connection Vacuum Breakers.
- Y. ASSE 1012 (American Society of Sanitary Engineering) - Backflow Preventers with Immediate Atmospheric Vent.
- Z. ASSE 1013 (American Society of Sanitary Engineering) - Backflow Preventers, Reduced Pressure Principle.
- AA. ASSE 1019 (American Society of Sanitary Engineering) - Wall Hydrants, Frost Proof Automatic Draining Anti-Backflow Types.
- BB. AWWA C506 (American Water Works Association) - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
- CC. PDI WH-201 (Plumbing and Drainage Institute) - Water Hammer Arrestors.
- DD. ASHRAE 90A (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Energy Conservation in New Building.

1.3 SUBMITTALS

- A. Submittals: Provide as per the General Conditions of the Contract.
- B. Product Data:
 - 1. Submit data on pipe materials; pipe fittings, valves, and accessories. Submit manufacturers catalog information. Indicate valve data and ratings.

- C. Manufacturer's Installation Instructions: Submit installation instructions for valves and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves and equipment.
- B. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

- A. Copper Tubing: ASTM B42, hard drawn.
 - 1. Fittings: ASME B16.18 cast copper alloy or ASME B16.22 wrought copper and bronze.
 - 2. Joints: AWS A5.8, BCuP silver braze.
- B. Copper Tubing: ASTM B42, annealed
 - 1. Fittings: ASME B16.26 cast bronze.
 - 2. Joints: Flare

1.8 WATER PIPING, ABOVE GRADE

- A. Copper Tubing: ASTM B88 (ASTM B88M), Type L, hard drawn.
 - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
 - 2. Joints: ASTM B32, solder, Grade 95TA.
- B. Copper Tubing: ASTM B88 (ASTM B88M), Type L, hard drawn.
 - 1. Fittings: Cast iron, coated
 - 2. Joints: Grooved mechanical couplings
- C. Once in the Apartment Unit: PVC or PEX Tubing is allowed.
 - 1.
 - 2.

1.9 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size **3 inches (80 mm)** and Under:
 - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
 - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Pipe Size Over **1 inch (25 mm)**:
 - 1. Ferrous pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
 - 2. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Grooved and Shouldered Pipe End Couplings:
 - 1. Housing: Malleable iron clamps to engage and lock, designed to permit some angular deflection, contraction, and expansion; steel bolts, nuts, and washers; galvanized for galvanized pipe.
 - 2. Sealing gasket: "C" shape composition sealing- gasket.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

1.10 PIPE HANGERS AND SUPPORTS

- A. Provide as per Section 220529.

1.11 WATER PRESSURE REDUCING VALVES

- A. Up to 2 inches (50 mm):
 - 1. MSS SP-80, bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, and double union ends.
- B. Over **2 inches (50 mm)**:
 - 1. MSS SP-85, cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flange

1.12 RELIEF VALVES

- A. Pressure Relief:
 - 1. AGA Z21.22 certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuate.
- B. Temperature and Pressure Relief:
 - 1. AGA Z21.22 certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum **210 degrees F (98.9 degrees C)**, capacity ASME SEC IV certified and labeled.

1.13 STRAINERS

- A. Size **2 inch (50 mm)** and Under:
 - 1. Threaded brass body for **175 psi (1200 kPa)** CWP, Y pattern with **1/32 inch (0.8 mm)** stainless steel perforated screen.
- B. Size **1-1/2 inch (40 mm)** to **4 inch (100 mm)**:
 - 1. Class 125, flanged iron body, Y pattern with **1/16-inch (1.6 mm)** stainless steel perforated screen.

- C. Size 5 inch (125 mm) and Larger:
 - 1. Class 125, flanged iron body, basket pattern with 1/8 inch (2 mm) stainless steel perforated screen.

1.14 FIRE STOP SYSTEMS

- A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.
- B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

1.15 HOSE BIBS

- A. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lock shield and removable key, integral vacuum breaker in conformance with ANSI/ASSE 1011.
- B. Interior Mixing: Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with hand wheels, and vacuum breaker in conformance with ANSI/ASSE 1011.

1.16 HYDRANTS

- A. Wall Hydrant(Sillcock): ANSI/ASSE 1019; non-freeze, self-draining type with polished bronze, wall plate, lockable recessed box, hose thread spout, hand wheel, locks shield and removable key, and integral vacuum breaker.

1.17 BACKFLOW PREVENTERS

- A. Manufacturers: Conbraco, Watts, Febco, Hersey.
- B. Reduced Pressure Backflow Preventers: ANSI/ASSE 1013 AWWA C506
 - 1. Bronze body, with bronze internal parts and stainless steel springs.
 - 2. Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

1.18 WATER HAMMER ARRESTORS

- A. Manufacturers: Precision Plumbing Products Company (Wade Shokstop, JR Smith, Josam, Zurn)
- B. ANSI A1126.1; copper, construction, bellows, type sized in accordance with PDI WH-201.
- C. Pre-charged suitable for operation in temperature range 34 to 250 degrees F and maximum 150 psi (1000 kPa) working pressure.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavate

2.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.

2.3 INSTALLATION

- A. Install Work in accordance with International Plumbing Code and local / jurisdictional codes.
- B. Install trap primers on all floor drains and floor sinks.
- C. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- D. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- E. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
- F. Group piping whenever practical at common elevations.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220529.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- I. Establish elevations of buried piping outside the building to obtain not less than 3-1/2 ft of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Install water piping in accordance with ASME B31.9.
- M. Sleeve pipes passing through partitions, walls and floors.
- N. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

- O. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9 ASTM F708 and MSS SP89, and IPC Table.
 - 2. Support horizontal piping as schedule
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 7. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping.
- P. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
- Q. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.
- R. Install water hammer arrestors in accordance to plumbing drainage institute standard WH-201. Provide 8" x 8" access panel to provide access to arrestor.

2.4 SERVICE CONNECTIONS

- A. Provide new water service complete with approved reduced pressure back-flow preventer and pressure reducing valve and sand strainer.
- B. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

END OF SECTION

SECTION 22 13 00
SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe, pipe fittings, connections and equipment for sanitary sewer piping systems. This section also includes floor drains, cleanouts, interceptors, manholes and sewage ejectors.
- B. Related Sections:
 - 1. Section 220553 - Mechanical Identification: Product requirements for pipe identification for placement by this section.
 - 2. Section 220529: Hangers and Supports.

1.2 REFERENCES

- A. ASME B13 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.
- B. ASME B123 (American Society of Mechanical Engineers) - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.
- C. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- D. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- E. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- F. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- G. ASTM E814 - Fire Tests of Through-Penetration Fire Stops.
- H. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- I. ASME A1121.1 (American Society of Mechanical Engineers) - Floor Drains.
- J. CISPI 301 (Cast Iron Soil Pipe Institute) - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- K. CISPI 310 (Cast Iron Soil Pipe Institute) - Joints for Hubless Cast Iron Sanitary Systems.
- L. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- M. SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- N. UL 1479 (Underwriters Laboratories, Inc.) - Fire Tests of Through-Penetration Firestops.

1.3 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.

- B. Product Data: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information. Indicate component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

- 2.1 All grease waste pipe shall be solid core PVC unless otherwise specified.

2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING.

- A. Solid Core PVC Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. Solid Core PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets.

2.3 SANITARY SEWER AND VENT PIPING, ABOVE GRADE

- A. Cast Iron Pipe: CISPI 301, hub-less, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
 - 3. All elbows joining a stack more than 2 stories shall use extra heavy duty no-hub bands (minimum of 4 bands on each pipe) exceeding minimum CISPI 310 requirements.
- B. Polyvinyl Chloride (PVC) Solid Core Plastic Pipe: ASTM D 2665, ASTM D 2949, ASTM F 891, CSA B181.2, ASTM F 1488.
 - 1. Fittings: PVC meeting ASTM D 3311, ASTM D 2665, ASTM F 1866.
 - 2. Joints: See 2009 IPC Section 705.
 - 3. PVC and Cast iron piping are shown. Plastic piping is not allowed to be installed in the return air plenums. Contractor is allowed to use Plastic piping from below grade and up the wall to 12" below the ceiling level. All piping located above the ceilings is to be cast iron piping.

2.4 PIPE HANGERS AND SUPPORTS

- A. Drain, Waste, and Vent: Conform to ASME B31.9, ASTM F708.
- B. Hangers for Pipe Sizes **1/2 to 1-1/2 inch (15 to 40 mm)**: Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes **2 inches (50 mm)** and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to **3 inches (80 mm)**: Cast iron hooks.
- F. Wall Support for Pipe Sizes Over **3 inches (100 mm)**: Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- I. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

2.5 FIRE STOP SYSTEMS

- A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.
- B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

2.6 FLOOR DRAINS

- A. Manufacturers: Wade, JR Smith, Zurn.
- B. Provide as scheduled on the Drawings.
- C. Floor Drain: Lacquered cast iron two piece body with drainage flange, heavy duty grate **6 inches (150 mm) 12 inches (300 mm)** wide, **12 inches (300 mm)** long, dome strainer, end plates with gaskets.
- D. Contractor must verify with G.C., engineer, and/or owner a water tight seal on all floor drains and floor sinks installed in the penthouse. Water tight seal includes seal between fixture and concrete floor, piping, and fixture itself.

2.7 FLOOR SINKS

- A. Manufacturers: Wade, J.R. Smith, Zurn.
- B. Provide as scheduled on the Drawings.

- C. Contractor must verify with G.C., engineer, and/or owner a water tight seal on all floor drains and floor sinks installed in the penthouse. Water tight seal includes seal between fixture and concrete floor, piping, and fixture itself.

2.8 CLEANOUTS

- A. Manufacturers: Wade, J.R. Smith, Zurn.
- B. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.
- C. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- D. Interior Finished Floor Areas: Galvanized cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- E. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- F. Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install Work in accordance with current adopted IPC and current local / jurisdictional standards.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearances at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Do not spread piping, conserving space.
- H. Install floor drains, floor sinks, and floor cleanouts in the penthouse with a water tight seal between fixture and concrete. Verify water tight seal by flooding drain and continuous water flow around fixture from concrete for a period of 8 hours.
- I. Group piping whenever practical at common elevations.
- J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
- K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- O. Install bell and spigot pipe with bell end upstream.
- P. Sleeve pipes passing through partitions, walls and floors.
- Q. Inserts:
 - 1. Provide inserts for placement in concrete forms.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.
- R. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708.
 - 2. Support horizontal piping as scheduled.
 - 3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
 - 4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
 - 5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
 - 7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
 - 8. Provide copper plated hangers and supports for copper piping packing between hanger or support and piping.

END OF SECTION

SECTION 22 14 00
STORM DRAINAGE PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pipe, pipe fittings, connections and equipment for storm water piping systems. This Section also includes roof and floor-drains, cleanouts.
- B. Related Sections:
 - 1. Section 22 05 29: Hangers and Supports.

1.2 REFERENCES

- A. ASTM A74 - Cast Iron Soil Pipe and Fittings.
- B. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
- C. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- D. CISPI 301 - (Cast Iron Soil Pipe Institute) Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
- E. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- F. ASME A112.21.2 (American Society of Mechanical Engineers) - Roof Drains.
- G. AWWA C110 (American Water Works Association) - Ductile - Iron and Gray - Iron Fittings 3 in. through 48 in., for Water and Other Liquids.
- H. AWWA C151 (American Water Works Association) - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
- I. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and Manufacturer
- J. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

- A. Provide in accordance with the General Contract.
- B. Product Data: Submit data on pipe materials, fittings, and accessories. Submit manufacturers catalog information. Submit component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 STORM WATER PIPING, BURIED WITHIN 5 FEET (1500 mm) OF BUILDING

- A. PVC Solid Core Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
- B. PVC Solid Core Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM F477, elastomeric gaskets

2.2 STORM WATER PIPING, ABOVE GRADE

- A. PVC Solid Core Pipe: ASTM D2665 or ASTM D3034.
 - 1. Fittings: PVC.
 - 2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement
- B. Cast Iron Pipe: CISPI 301, hub-less, service weight.
 - 1. Fittings: Cast iron.
 - 2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- C. PVC and Cast iron piping are shown. Plastic piping is not allowed to be installed in the return air plenums. Contractor is allowed to use Plastic piping in return air plenums from below grade and up the wall to 12" below the ceiling level. All piping located above the ceilings is to be cast iron piping.

2.3 PIPE HANGERS AND SUPPORTS

- A. Drain, Waste, and Vent: Conform to ASME B31.9, ASTM F708.
- B. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm): Carbon steel, adjustable swivel, split ring.
- C. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.
- D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- E. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hook.
- F. Wall Support for Pipe Sizes Over 3 inches (100 mm): Welded steel bracket and wrought steel clamp.
- G. Vertical Support: Steel riser clamp.

- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- I. Copper Pipe Support: Carbon-steel, copper-plated adjustable ring.

2.4 FIRE STOP SYSTEMS

- A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with intumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.
- B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with intumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

2.5 ROOF DRAINS

- A. Manufacturers: Wade, J.R. Smith, Zurn.
- B. Roof Drain (RD-1): Cast Iron Body: 15" nominal size with cast iron dome, flashing clamp, deck clamp, bearing pan/receiver and vandal proof screws. See Drawings for pipe size.
- C. Overflow Roof Drain (OD-1): Cast Iron Body, 15" nominal size with cast iron dome, flashing clamp, deck clamp, bearing pan/receiver, vandal proof screws and 2" stand pipe or dam as required for drain style.

2.6 DOWNSPOUT NOZZLES

- A. Manufacturers: Wade, J.R. Smith, Zurn.
- B. Downspout Nozzle: Nickel bronze with wall flange.

2.7 CLEANOUTS

- A. Exterior Surfaced Areas: Round cast nickel bronze access frame and non-skid cover.
- B. Exterior Unsurfaced Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket.
- C. Interior Finished Floor Areas: Lacquered galvanized cast iron body with anchor flange, threaded top assembly, and round scored cover with gasket in service areas and round depressed cover with gasket to accept floor finish in finished floor areas.
- D. Interior Finished Wall Areas: Line type with lacquered cast iron body and round epoxy coated cover with gasket, and round stainless steel access cover secured with machine screw.
- E. Interior Unfinished Accessible Areas: Caulked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

- A. Install Work in accordance with International Plumbing Code and current local / jurisdictional codes.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Provide clearance at cleanout for snaking drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install non-conducting dielectric connections wherever jointing dissimilar metals.
- F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- G. Install piping to maintain headroom. Group piping to conserve space.
- H. Group piping whenever practical at common elevations.
- I. Flash all drains on roof with 24" x 24" minimum flashing pan.
- J. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.
- K. Terminate storm and overflow drains into full size nickel bronze downspout nozzle as indicated on the Drawings. Seal space between wall opening and pipe with silicone seal. Anchor nozzle wall flange with 1/4" flat head machine bolts and lead expanders.
- L. Install piping penetrating roofed areas to maintain integrity of roof assembly.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- N. Install bell and spigot pipe with bell end upstream.
- O. Sleeve pipes passing through partitions, walls and floors.
- P. Inserts:
 - 1. Provide inserts for placement in concrete forms.

2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

Q. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
4. Place hangers within 12 inches (300 mm) of each horizontal elbow.
5. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Support cast iron drainage piping at every joint.

3.4 ERECTION TOLERANCES

- A. Establish invert elevations, slopes for drainage as indicated on Drawings.

END OF SECTION

SECTION 22 34 00 – FUEL-FIRED DOMESTIC WATER HEATERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes water heaters, packaged water heating systems, domestic water heat exchangers and water storage tanks.
- B. Related Sections:
 - 1. Section: 22 40 00 – Plumbing Fixtures (Optional short phrase).
 - 2. Division 16 - Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 SUBMITTALS

- A. Submittals: Provide in accordance with the General Conditions of the Contract.
- B. Manufacturer's Installation Instructions: Submit mounting and support requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit replacement part numbers and availability.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept water heaters on site in original labeled cartons. Inspect for damage.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 WARRANTY

- A. Furnish 1-year manufacturer warranty for domestic water heaters packaged water heating systems.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

- A. Manufacturers: A.O. Smith, Bradford White, Ruud, State Industries, P.V.I. Industries, or equal.
- B. Type: Factory-assembled and wired, natural gas or electric, vertical storage.
- C. Tank: Glass lined welded steel; 4-inch (100 mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.

- D. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.
- E. Accessories: Brass water connections and dip tube, drain valve, magnesium anode, and ASME rated temperature and pressure relief valve.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with International or Uniform Plumbing Code and local jurisdiction codes.
- B. Install water heaters in accordance with UL requirements.
- C. Coordinate with plumbing piping and related electrical Work to achieve operating system.

END OF SECTION

**SECTION 22 40 00
PLUMBING FIXTURES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes water closets, urinals, lavatories, faucets, sinks, service sinks, and electric water coolers.
- B. Related Sections:
 - 1. Section 221100 – Domestic Water Piping: Supply connections to plumbing fixtures.
 - 2. Section 221300 – Sanitary Waste and Vent Piping: Waste connections to plumbing fixtures.

1.2 REFERENCES

- A. ARI 1010 (Air-Conditioning and Refrigeration Institute) - Drinking Fountains and self-contained Mechanically Refrigerated Drinking Water Coolers.
- B. ASME A112.6.1 (American Society of Mechanical Engineers) - Supports for Off-the-Floor Plumbing Fixtures for Public Use.
- C. ASME A112.18.1 (American Society of Mechanical Engineers) - Finished and Rough Brass Plumbing Fixture Fittings.
- D. ASME A112.19.1 (American Society of Mechanical Engineers) - Enameled Cast Iron Plumbing Fixtures.
- E. ASME A112.19.2 (American Society of Mechanical Engineers) - Vitreous China Plumbing Fixtures.
- F. ASME A112.19.3 (American Society of Mechanical Engineers) - Stainless Steel Plumbing Fixtures.
- G. ASME A112.19.4 (American Society of Mechanical Engineers) - Porcelain Enameled Formed Steel Plumbing Fixtures.
- H. ASME A112.19.5 (American Society of Mechanical Engineers) - Trim for Water-Closet Bowls, Tanks, and Urinals.

1.3 SUBMITTALS

- A. Submittal: Provide in accordance with the General Conditions of the Contract.
- B. Product Data: Submit catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Installation Instructions: Submit installation methods and procedures.

1.4 CLOSEOUT SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.

- B. Operation and Maintenance Data: Submit fixture, trim, exploded view and replacement parts lists.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

- A. Manufacturers: Kohler, Zurn, Sloan, and American Standard.
- B. Provide as scheduled on the Drawings.

2.2 WALL HUNG URINALS

- A. Manufacturers: Kohler, Zurn, Sloan, and American Standard.
- B. Provide as scheduled on the Drawings.

2.3 WALL HUNG URINALS

- A. Manufacturers: Kohler, Zurn, Sloan, and American Standard..
- B. Provide as scheduled on the Drawings.

2.4 LAVATORIES

- A. Manufacturers: Kohler, Zurn, Sloan, and American Standard.
- B. Provide as scheduled on the Drawings.

2.5 FAUCETS

- A. Manufacturers: Just, Elkay, Zurn, Chicago Faucet, Kohler.

2.6 ELECTRIC WATER COOLERS

- A. Manufacturers: Elkay, Haws, Oasis, and Sunroc.
- B. Provide as scheduled on the Drawings.

2.7 SERVICE SINKS

- A. Manufacturers: Kohler, Mustee, and American Standard.
- B. Provide as scheduled on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify electric power is available and of correct characteristics.
- C. Confirm millwork is constructed with adequate provision for installation of counter top lavatories and sinks.

3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

- A. Install Work in accordance with International Plumbing Code and local / jurisdictional codes.
- B. Install each fixture with trap, easily removable for servicing and cleaning.
- C. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- D. Install components level and plumb.
- E. Install and secure fixtures in place with wall carriers and bolts.
- F. Seal fixtures to wall and floor surfaces with sealant color to match fixture.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Review millwork shop-drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not permit use of fixtures before final acceptance.

END OF SECTION

SECTION 23 00 15
GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Coordination and project conditions.
- B. Products, product options and substitutions.
- C. Closeout procedures.
- D. Bids and Submittals.
- E. Test and inspection.
- F. Regulatory requirements.
- G. Cutting and patching.
- H. Special procedures.
- I. Alternate Bid Pricing: Equipment List

1.2 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Provide all labor, materials and equipment necessary for completely finished and operational systems as described and specified.
- C. Verify utility requirements and characteristics of operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, operating equipment.
- D. Coordinate space requirements, supports, and installation of mechanical Work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs. Provide incidental items such as offsets, fittings and accessories required for a completely operational mechanical system.
- E. In finished areas, except as otherwise indicated, conceal pipes, ducts, and wiring within construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of Work in preparation for Substantial Completion.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 BIDS & SUBMITTAL PROCEDURES

- A. During the bid phase, contractors / vendors will submit prior approvals for equipment to the engineer for approval. If there is no response from the engineer on any prior approval, then the equipment and/or material submitted has not been approved.
- B. The schedule sheets on the plans and the specifications are the minimum performance all equipment must meet or exceed.
- C. Transmit each submittal with Architect/Engineer accepted form.
- D. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- E. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.
- F. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- G. Schedule submittals to expedite Project, and deliver to Architect/Engineer. Coordinate submission of related items. Mechanical & plumbing plans reflect engineer's choice that ALL equipment must meet or exceed in performance listed in the plans. Contractors can bid equipment "As Equal" for all equipment for equipment approved in these specifications.
- H. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.
- I. Identify variations from Contract Documents and product or system limitations, which may be detrimental to successful performance of completed Work.
- J. Allow space on submittals for Contractor and Architect/Engineer review stamps.
- K. When revised for resubmission, identify changes made since previous submission.
- L. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

1.4 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Owner-Contractor Agreement Notice to Proceed, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 PRODUCT DATA

- A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as described.
- B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- E. After review distribute in accordance with Submittal Procedures article above and provide copies for record documents described.

1.6 SHOP DRAWINGS

- A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents. Produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01700. Items requiring shop drawings are ductwork, piping and fire sprinklers.
- B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.7 TEST REPORTS

- A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.
- B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.8 CERTIFICATES

- A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.9 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.

- B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.10 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturer's installation instructions, including each step in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Balancing contractor shall meet mechanical engineer on site and perform random water, hydronic, and/or air test to verify documented balance reports. The location of the tests shall be the discretion of the mechanical engineer.
- G. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- H. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
- I. It is the contractors responsibility to not only ensure equipment is installed properly and has been started properly, but also that the "system" is operating properly. Air handlers can run, boilers can fire, chillers can start, but proper system operation of each individual equipment working together to maintain temperature, pressure, humidity, etc. is crucial.
- J. Mechanical contractor is to notify mechanical engineer of completion of DOAS air handling unit and main supply duct shafts. ERV exhaust duct is to be pressurized and pressure tested for tightness, and leakage rate acceptable to engineer's approval and per SMACNA Duct Standards.

1.11 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturer's tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification form Architect/Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.12 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

- B. Conform to reference standard and all applicable codes, ordinances and regulations in effect, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.
- E. Comply with the latest editions of the following:
 - a. 2018 International Mechanical Code and Appendix A
 - b. 2018 International Building Code;
 - c. 2018 International Fuel Gas Code and Appendices A, B, C, and D
 - d. 2018 International Fire Code.
 - e. NFPA 99
 - f. State Department of Health Standards
 - g. State Boiler Code
 - h. 2018 International Energy Conservation Code;
 - i. National Fire Protection Standards;
 - j. National Electric Code;
 - k. Any and all state or local amendments to the above codes.
- F. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.13 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.
- C. Furnish interchangeable components from same manufacturer for components being replaced.

1.14 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instruction.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.15 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

- D. For exterior storage of fabricated products, place on sloped supports above ground.
- E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- G. All duct is to arrive on site clean, new, and in working order. All supply duct is to arrive cleaned and bagged seal. Once all duct is installed, all ends are to be bagged sealed until final termination is installed.
- H. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

1.16 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.17 PRODUCT SUBSTITUTION PROCEDURES

- A. Architect/Engineer will consider requests for Substitutions only within 10 days after date established in Notice to Proceed.
- B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- D. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 - 5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

- F. Substitution Submittal Procedure:
 - 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 - 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
 - 3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

1.18 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.

1.19 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.
- C. If the roof top units (RTU's) or air handling unit(s) (ahus or DOAS Units) is going to be started before the final (used for heating or cooling or even if the fans are going to turn), install temporary filters and a roll filter mesh in front of the filters. Replace mesh when the mesh filter media becomes dirty. Once air handler has been completed and all test & balance is completed, building is all swept, building has been painted, ahu has been painted / epoxy coated (complete); then replace the filters in the ahu and leave one full set in the case with the owner.
- D. Replace filters of operating equipment.
- E. Clean debris from roofs, gutters, downspouts, and drainage systems.
- F. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.20 STARTING OF SYTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer seven days prior to start-up of each item.
- C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment

or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.21 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. Demonstrate Project equipment and instruct by manufacturer's representative who is knowledgeable about the Project.
- C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time agreed time, at designated location.
- F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.22 TESTING, ADJUSTING AND BALANCING

- A. Independent firm will perform services specified in Section 23 05 93.
- B. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with requirements of Contract Documents.
- C. Balancing contractor shall meet mechanical engineer on site and perform random water, hydronic, and/or air test to verify documented balance reports. The location of the tests shall be the discretion of the mechanical engineer.

1.23 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

1.24 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.

- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.
- G. Submit documents to Architect/Engineer.

1.25 OPERATION AND MAINTENANCE DATA

- A. Submit data bound in 8-1/2 x 11 inch (A4) text pages, three D side ring binders with durable plastic cloth covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Photocopies of warranties and bonds.

1.26 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy be reviewed and returned [after final inspection], with Architect/Engineer comments. Revise content of document sets as required prior to final submission.
- D. Submit three sets of revised final volumes in final form within 10 days after final inspection.
- E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
- F. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- G. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- H. Include servicing and lubrication schedule, and list of lubricants required.
- I. Include manufacturer's printed operation and maintenance instructions.
- J. Include sequence of operation by controls manufacturer.
- K. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- L. Include control diagrams by controls manufacturer as installed.
- M. Include Contractor's coordination drawings, with color coded piping diagrams as installed.
- N. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- O. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- P. Include test and balancing reports as specified in Section 230593.

- Q. Additional Requirements: As specified in individual product specification sections.
- R. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.27 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.
- B. Deliver to Project site. Obtain receipt.

PART 2 - PRODUCTS FOR ALTERNATE BIDS

2.1 SECTION INCLUDES

- A. Contractors shall separate & list certain portions of the mechanical equipment. See drawings.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes testing, adjusting, and balancing of air systems, testing, adjusting, and balancing of hydronic systems, measurement of final operating condition of HVAC systems, sound measurement of equipment operating conditions, vibration measurement of equipment operating conditions.

1.2 REFERENCES

- A. AABC (Associated Air Balance Council) - National Standards for Total System Balance.
- B. ASHRAE 111 (American Society of Heating, Refrigerating and Air-Conditioning Engineers) - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- C. NEBB (National Environmental Balancing Bureau) - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- D. Refer to Spec Section 22 05 53: Mechanical Identification.

1.3 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Test Reports: Indicate data on AABC National Standards for Total System Balance forms or NEBB Report forms.
- C. Field Reports: Indicate deficiencies preventing proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- D. Prior to commencing Work, submit report forms or outlines indicating adjusting, balancing, and equipment data required.
- E. Submit draft copies of report for review prior to final acceptance of Project. Furnish final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- F. Furnish reports in a 3-ring binder manuals, complete with table of contents page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- G. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty and Copy of NEBB Certificate of Conformance Certification prior to commencing system balance.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of flow measuring stations balancing valves and rough setting.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems
- B. Maintain one copy of each document on site.

1.6 QUALIFICATIONS

- A. Agency: Company specializing in testing, adjusting, and balancing of systems specified in this section with minimum 10 years documented experience Certified by NEBB.
- B. Perform Work under supervision of NEBB Certified Testing, Balancing and Adjusting Supervisor.
- C. Sequence balancing between completion of systems tested and Date of Substantial Completion.

1.7 SCHEDULING

- A. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify systems are complete and operable before commencing work. Verify the following:
 - 1. Systems are started and operating in safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.
 - 4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
 - 5. Duct systems are clean of debris.
 - 6. Fans are rotating correctly.
 - 7. Fire and volume dampers are in place and open.
 - 8. Air coil fins are cleaned and combed.
 - 9. Access doors are closed and duct end caps are in place.
 - 10. Air outlets are installed and connected.
 - 11. Duct system leakage is tested and meets specification set points.
 - 12. Air Handling Unit leakage is tested and meets specification set points.
 - 13. Hydronic systems are flushed, filled, and vented. T & B contractor must have the flush & cleaning reports on hand when performing test & balancing.
 - 14. Pumps are rotating correctly.
 - 15. All springs (inertia bases, in-line pumps, supply fans, exhaust fans, etc.) have the factory shipping support blocks removed.
 - 16. Springs have been adjusted to vibration movement distances.
 - 17. Proper strainer baskets are clean and in place or in normal position.

18. Service and balancing valves are open.

a. If T & B contractor notices any discrepancy, he is to notify the M.C. and G.C. within 24 hours, document the findings, and proceed.

B. Submit field reports. Report defects and deficiencies noted during performance of services, preventing system balance.

3.2 PREPARATION

A. Furnish instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

3.3 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4 ADJUSTING

A. Verify recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted. If disrupted, verify correcting adjustments have been made.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by Owner.

F. Check and adjust systems approximately six months after final acceptance and submit report.

3.5 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to obtain required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in main ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts.

- E. Use volume control devices to regulate air quantities only to extent adjustments do not create objectionable air motion or sound levels. Effect volume control by using volume dampers located in ducts.
- F. Vary total system air quantities by adjustment of fan speeds. Provide sheave drive changes to vary fan speed. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. At modulating damper locations, take measurements and balance at extreme conditions. Balance variable volume systems at maximum airflow rate, full cooling, and at minimum airflow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to obtain required relationship between each to maintain approximately 0.05 inches positive static pressure near building entries.
- M. Verify fire/smoke dampers operate properly on all floors.

3.6 WATER SYSTEM PROCEDURE

- A. Adjust water systems, after air balancing, to obtain design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow-metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in system.
- C. Adjust systems to obtain specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open or in normal position to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, simulate full flow in one part by temporary restriction of flow to other parts.
- G. Check and adjust if necessary all three towers sump levels. Verify sump height is maintained as pumps start & stop.

3.7 SYSTEM TESTING

- A. Test & balance contractor is to include in his bid to provide an additional 40 hours of on-site return trips, changes to the system, “tweeks”, equipment changes and adjustments, engineer requested changes or adjustments after the building has been issued its Certificate of Occupancy.
- B. Test & Balance Contractor must have the flush & cleaning reports of all systems while on-site balancing.
- C. Test & Balance contractor shall verify system operation along with the controls contractor including but not limited to:
 - 1. Domestic heating water pump aqua stat set point and proper on/off operation.
 - 2. Parking Garage ventilation fans ramp according to CO and Nitrous Oxide levels.
 - 3. Sub-Slab Drainage pumps ramp accordingly.

END OF SECTION

SECTION 23 08 00
COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 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.
- B. Commissioning is to be performed from 2012 IECC, Section C408.

1.2 SUMMARY

- A. Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
- B. Related Sections:
 - 1. Section 019113 "General Commissioning Requirements" for general commissioning process requirements.

1.3 DEFINITIONS

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 INFORMATIONAL SUBMITTALS

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

1.5 ALLOWANCES

- A. Not applicable.

1.6 UNIT PRICES

- A. Not applicable.

1.7 CONTRACTOR'S RESPONSIBILITIES

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend construction phase controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.
- E. All work by the G.C, mechanical contractor, plumbing contractor, test & balance contractor, and ATC contractor is to include the work for the commissioning. This includes, but not limited to systems adjusting and balancing, air systems balancing, hydronic systems balancing, functional performance testing, economizer operation of applicable equipment, water flushing & cleaning reports, and all other documented reports.
- F. Provide information requested by the CxA for final commissioning documentation.
- G. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.
- H. Send a copy of the Preliminary Commissioning Report to the building owner. The building owner will need to send a letter of transmittal to the Code Official that he has received the Preliminary Commissioning Report. Preliminary Commissioning Report shall be made available for review for the code official.
- I. Operating and Maintenance Manual from section 23 05 93 and including the items from IECC Section C408.2.5.1 & C408.2.5.2.
- J. Test & Balance Contractor is to compile a written report describing the activities and measurements completed in accordance with C408.2.2. Once completed, send a copy of the report to the CxA.

1.8 CxA'S RESPONSIBILITIES

- A. Develop a commissioning plan:
 - 1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
 - 2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
 - 3. Functions to be tested, including, but not limited to calibrations and economizer controls.
 - 4. Conditions under which the test will be performed. At a minimum, testing shall affirm winter and summer design conditions and full outside air conditions.
 - 5. Measurable criteria for performance.
- B. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- C. Direct commissioning testing.
- D. Verify testing, adjusting, and balancing of Work are complete.

1. Prepare a preliminary report of commissioning test procedures and results. Reports are to incorporate the following:
 - a. Itemization of deficiencies found during testing required by IECC Section C408 that have not been corrected at the time of report preparation.
 - b. Deferred tests than cannot be performed of climate conditions.
 - c. Climatic conditions required for performance of the deferred test.
- E. Provide test data, inspection reports, and certificates in Systems Manual and in accordance with 2012 IECC, Section C408.
- F. Prepare a Final Commissioning Report per Section C408.2.5.4

1.9 COMMISSIONING DOCUMENTATION

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
 2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
 3. Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
 4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
 5. Certificate of readiness certifying that HVAC&R systems, subsystems, equipment, and associated controls are ready for testing.
 6. Test and inspection reports and certificates.
 7. Corrective action documents.
 8. Verification of testing, adjusting, and balancing reports.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TESTING PREPARATION

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.
- B. Certify that HVAC&R instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 Testing AND BALANCING VERIFICATION

- A. Prior to performance of testing and balancing Work, provide copies of reports, sample forms, checklists, and certificates to the CxA.
- B. Notify the CxA at least **10** days in advance of testing and balancing Work, and provide access for the CxA to witness testing and balancing Work.
- C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC&R systems at the direction of the CxA.
 - 1. The CxA will notify testing and balancing **Contractor 10** business days in advance of the date of field verification. Notice will not include data points to be verified.
 - 2. The testing and balancing **Contractor** shall use the same instruments (by model and serial number) that were used when original data were collected.
 - 3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
 - 4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.3 GENERAL TESTING REQUIREMENTS

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. The CxA along with the HVAC&R Contractor, testing and balancing Contractor, and HVAC&R Instrumentation and Control Contractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- E. Tests will be performed using design conditions whenever possible.

- F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- G. The CxA may direct that set points be altered when simulating conditions is not practical.
- H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- I. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.4 HVAC&R systems, subsystems, and equipment Testing Procedures

- A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in HVAC boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.
- B. HVAC&R Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Section 230900 "Building Automation System" and Section 230993 "Sequence and Operations for HVAC Controls.". Assist the CxA with preparation of testing plans.
- C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in HVAC piping Sections. HVAC&R Contractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, and treating plan and final reports to the CxA. Plan shall include the following:
 - 1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
 - 2. Description of equipment for flushing operations.
 - 3. Minimum flushing water velocity.
 - 4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.
- D. Energy Supply System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of gas & hot water systems and equipment at the direction of the CxA. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.
- E. Refrigeration System Testing (if applicable): Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

- F. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air, steam, and hydronic distribution systems; special exhaust; and other distribution systems, including HVAC&R terminal equipment and unitary equipment.
- G. Vibration and Sound Tests: Provide technicians, instrumentation, tools, and equipment to test performance of vibration isolation and seismic controls.

END OF SECTION 23 08 00

SECTION 23 09 00
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 DESCRIPTION

- A. This specification is to cover a complete Adjustable Frequency motor Drive (AFD) [also called Variable Frequency Drive (VFD)] consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor. The drive shall be designed specifically for variable torque applications, and shall be designated "ACH400". It is required that the drive manufacturer have an existing:
 - 1. Sales representative exclusively for HVAC products, with expertise in HVAC systems and controls.
 - 2. An independent service organization.
- B. The drive and all necessary controls as herein specified shall be supplied by the drive manufacturer. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of ten years.

1.2 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. ABB
 - 2. Mitsubishi
 - 3. In the event that the wet side and dry side have separate contractors representing different suppliers of VFD's, only one manufacturer shall be used for the entire project.
- B. Referenced Standards:
 - 1. Institute of Electrical and Electronic Engineers (IEEE)
 - a. Standard 519-1992, IEEE Guide for Harmonic Content and Control.
 - 2. Underwriters laboratories
 - a. UL508C
 - 3. National Electrical Manufacturer's Association (NEMA)
 - a. ICS 7.0, AC Adjustable Speed Drives
 - 4. IEC 16800 Parts 1 and 2
 - 5. Lonmark
 - a. Function profile variable speed motor drive: 6010
- C. Testing:
 - 1. All printed circuit boards shall be completely tested and burned-in before being assembled into the completed AFD. The AFD shall then be subjected to a computerized systems test (cold), burn-in, and computerized systems test (hot). The burn-in shall be at 104°F (40°C), at full rated load.
 - 2. All testing and manufacturing procedures shall be ISO 9001 certified.
 - 3. All VFD's are to have IEEE filters.
- D. Failure Analysis:
 - 1. AFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray of components, and decap or delaminate of components and analyze failures within the component.
- E. Qualifications:

1. AFDs and options shall be UL listed as a complete assembly.
2. AFDs and options shall be cUL listed as a complete assembly.
3. AFDs and options shall be CE labeled as a component.

1.3 SUBMITTALS

- A. Submittals shall include the following information:
1. Outline Dimensions
 2. Weight
 3. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion.
 - a. The AFD manufacture shall provide calculations, specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the AFD manufacturer to ensure compliance with IEEE standard 519 (latest version), guide for Harmonic Control and Reactive Compensation for Static Power Converters. The acceptance of this calculation must be completed prior to AFD installation.
 - b. Prior to installation, the AFD manufacturer shall provide the estimated total harmonic distortion (THD) caused by the AFDs. The results shall be based on a computer aided circuit simulation of the total actual system, with information obtained from the power provider and the user.
 - c. If the voltage THD exceeds 5%, the AFD manufacturer is to recommend the additional equipment required to reduce the voltage THD to an acceptable level.

1.4 WARRANTY

- A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

PART 2 – PRODUCTS

2.1 ADJUSTABLE FREQUENCY DRIVES

- A. The adjustable frequency drives (AFDs) shall be solid state, with a Pulse Width Modulated (PWM) output. The AFD package as specified herein shall be enclosed in a NEMA 1 enclosure, completely assembled and tested by the manufacturer. The AFD shall employ a full wave rectifier (to prevent input line notching), Integral Line Reactor(s), Capacitors, and Insulated Gate Bipolar Transistors (IGBT's) as the output switching device. The drive efficiency shall be 97% or better at full speed and full load. Fundamental power factor shall be 0.98 at all speeds and loads.
- B. Specifications for the ACH400 3 HP to 400 HP at 480 volts and 2 to 100 HP at 240 volts:
1. Input 380/415/440/460/480 VAC +/- 10%, 3 phase, 48-63 Hz or input 208/220/230/240 VAC +/- 10%, 3 phase, 48-63 Hz. Under voltage trip @ rated input -35%, Over voltage trip @ rated input +30%.
 2. Interrupt rating 65 kAIC, suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amps, 480 V maximum.
 3. Output Frequency 0 to 250 Hz. Operation above 60 Hz shall require programming changes to prevent inadvertent high-speed operation.
 4. Environmental operating conditions: 0 to 40°C, 0 to 3300 feet above sea level, less than 95% humidity, non-condensing.
 5. Enclosure shall be rated NEMA 1 or NEMA 12.

- C. The adjustable frequency drive (AFD) will be BacNet certified and will incorporate all Mandatory and Optional Network Variables of the BacNet Functional profile: Variable Speed Motor Drive: 6010
- D. The following operating information displays shall be standard on the AFD digital display. All applicable operating values shall be capable of being displayed in engineering (user) units. A minimum of two operating values from the list below shall be capable of being displayed at all times. The display shall be in complete English words (alpha-numeric codes are not acceptable):
 - 1. Output Frequency,
 - 2. Motor Speed (RPM, %, or Engineering units),
 - 3. Motor Current,
 - 4. Calculated Motor Torque,
 - 5. Calculated Motor Power (kW),
 - 6. DC Bus Voltage,
 - 7. Output Voltage,
 - 8. Heatsink Temperature (° F),
 - 9. Analog Input Values,
 - 10. Analog Output Value,
 - 11. Keypad Reference Values,
 - 12. Elapsed Time Meter (resettable),
 - 13. kWh meter (resettable),
 - 14. mWh meter,
 - 15. Digital input status,
 - 16. Digital output status.
- E. The AFD shall have the following protection circuits. In the case of a protective trip, the drive shall stop, and announce the fault condition in complete words (alphanumeric codes are not acceptable).
 - 1. Over current trip 350% instantaneous (170% RMS) of the AFD's variable torque current rating.
 - 2. Over voltage trip 130% of the AFD's rated voltage.
 - 3. Under voltage trip 65% of the AFD's rated voltage.
 - 4. Over temperature +90° C, Heatsink Temperature.
 - 5. Ground Fault either running or at start.
 - 6. Adaptable Electronic Motor Overload (ft2). The Electronic Motor Overload protection shall protect the motor based on speed, load curve, and external fan parameter. Circuits, which are not speed dependant, are unacceptable. The electronic motor overload protection shall be UL Listed for this function.
- F. Speed Command Input shall be via:
 - 1. Keypad.
 - 2. Two Analog inputs, each capable of accepting a 0-20mA, 4-20mA, 0-10V, 2-10V signal.
 - 3. Floating point input shall accept a three-wire input from a Dwyer Photohelic (or equivalent type) instrument.
 - 4. BacNets Communications.
- G. Serial Communications
 - 1. The AFD shall have a BacNets port as standard. The standard protocol shall be Modbus.
 - 2. The AFD shall be able to communicate with other components via the BacNets port.
 - 3. BacNets communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, proportional/integral/derivative PID control (Set Point) adjustments, current limit, and accel/decel time adjustments.

- H. Optional Features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly.
1. Bypass Controller - Manual transfer to line power via contactors. Status LEDs to indicate the mode of operation, drive and bypass status and ready & enable conditions. When in the "Drive" mode, the bypass contactor is open and the drive output contactor is closed. In the "Bypass" position, the drive output contactor is open, and the bypass contactor is closed via Start/stop command. Start/stop via customer supplied maintained contact shall be 24V or 115V compatible and shall function in both the "Drive" and "Bypass" modes. The voltage tolerance of the bypass power supply shall be +30/-35% to eliminate the problem of contactor coil burnout. The design shall include single-phase protection in both the AFD and bypass modes.
 - a. Customer Interlock Terminal Strip – provide a separate terminal strip for connection of freeze, fire, smoke contacts, and external start command. All external safety interlocks shall remain fully functional whether the system is in Hand, Auto, Drive or Bypass modes.
 - b. Door / cover interlocked disconnect switch which will disconnect all input power from the drive, bypass and all internally mounted options. The disconnect handle shall be through the door, and be padlockable in the "Off" position.
 - c. Fast acting semi-conductor fuses exclusive to the AFD – fast acting semi-conductor fuses allow the AFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass capability. Bypass designs which have no such fuses, or that incorporate fuses common to both the AFD and the bypass will not be accepted. In such designs, a fuse clearing failure would render the bypass unusable.
 - d. Class 20 or 30 (selectable) electronic motor overload protection shall be included in the microprocessor bypass to protect the motor in bypass mode.
 2. Integral Input Reactors – equivalent 5% impedance. Note that the standard AFD includes 3% line reactor(s).
 3. NEMA 12 Enclosure - The optional NEMA 12 enclosure shall be UL Listed as Plenum rated.
 4. BacNets option - The optional BacNets board allows for 78 kBit/s Free Topology communications to BacNets networks.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. All VFD's shall be provided by mechanical and installed & wired by the electrical contractor. The electrical contractor shall install the drive in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.
- B. Power wiring shall be completed by the electrical contractor. The contractor shall complete all wiring in accordance with the recommendations of the AFD manufacturer as outlined in the installation manual.

3.2 START-UP

- A. Certified factory start-up shall be provided for each drive by a factory authorized service center. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

3.3 PRODUCT SUPPORT

- A. Factory trained application engineering and service personnel that are thoroughly familiar with the ACH 400 drive products offered shall be locally available at both the specifying and installation locations.

3.4 WARRANTY

- A. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of manufacturer. The warranty shall include all parts, labor, travel time and expenses.

END OF SECTION

SECTION 23 09 93

DIRECT DIGITAL CONTROLS SEQUENCE OF OPERATION

DEDICATED OUTDOOR AIR SYSTEM (DOAS) WITH ENERGY RECOVERY:

1. The DOAS system shall be enabled for operation during the occupied hours of building operation, as determined by the building owner's schedule (adjustable).
2. The DOAS ERV heat wheel in heating mode is enabled when the return air temperature is 5°F greater than the outside air temperature and discharge air temperature is below the discharge air temperature setpoint. After the heat wheel is enabled, it modulates speed to maintain the supply discharge air temperature setpoint. Gas heat is enabled and modulated when the supply discharge air temperature is less than the discharge air temperature setpoint and the heat wheel is at 100% speed. The discharge air temperature will be controlled to maintain 70°F.
3. The DOAS discharge air temperature shall have a reset schedule to be determined by building load and envelope conditions. Programming should be included to allow the discharge air to be increased +2-4 degs at outside air temperatures below 20 deg on a linear reset.
4. The DOAS supply fan shall be modulated to provide an initial duct static pressure of 1.5" W.C. (adjustable) or as determine by the balancer for the final CFM volume balance for the supply air system. There shall be a duct static pressure sensor located on the 3rd level supply air duct.
5. The DOAS exhaust fan shall be modulated to provide an initial duct static pressure of 1.5" W.C. (adjustable) or as determine by the balancer for the final CFM volume balance for the exhaust air system. There shall be a duct static pressure sensor located on the 3rd level return air duct.
6. The exhaust and supply air volume for each floor shall be modulated through a combination airflow monitoring station and damper on each level to maintain a building static pressure of .03" W.C. (Adjustable) as sensed on each level. Provide a space pressure sensor on each floor in each central core hallway.
7. Provide a software emergency shutdown point indicated on each DOAS graphic to disable DOAS operation by the building operator when required.

Provide a dedicated building level BACnet IP controller and network switch mounted in each DOAS unit and at a minimum, provide the following hard system points for each DOAS unit:

Supply Fan Start/Stop
Supply Fan Status
Supply Fan Speed
Exhaust Fan Start/Stop
Exhaust Fan Status
Exhaust Fan Speed
Enthalpy Wheel Enable
Enthalpy Wheel Status
Gas Burner Enable (for each gas stage)

Gas Burner Modulation
Gas Burner Status (for each gas stage)
Supply Air Duct Static Pressure
Exhaust Air Duct Static Pressure
Fire Alarm Shutdown
Outside Air Temperature
Building Static Pressure (each floor of the building)

VARIABLE REFRIGERANT FLOW (VRF) SYSTEM:

In addition to BACnet integration of the VRF System, the DDC contractor shall provide all thermostat stubs, concealed space conduit required, all system network wiring and terminations between system master, fan coils, reheat boxes and outdoor RCU's, space sensor wiring and space sensor termination and installation for the Variable Refrigerant Flow (VRF) system.

The VRF system shall be integrated into the DDC system through BACnet IP via the VRF system master controller for the building. The VRF system master controller shall be installed in DDC system enclosure and the DDC contractor shall provide all power, network switches and panel electrical devices for a complete installation of the VRF system.

Each VRF fan coil system shall have a graphic display to indicate the system set points, heating and cooling status of the zone, fan status and unit alarm. The heating and cooling set points shall be capable of override from the DDC system graphics and also through the local VRF room sensor display by the zone occupants. Each fan coil system point shall be trended for historical display of the zone performance. Indicate the following points on each fan coil zone graphic at a minimum:

Graphic of fan coil with animated fan, airflow and heat/cool coil status
Cooling Setpoint
Cooling Setpoint Status
Heating Setpoint
Heating Set point Status
Heat/Cool/Auto Command Mode
Heat/Cool/Auto Mode Status
Fan Start Stop
Fan Status
Alarm Status
Current Alarm Code

Each Floorplan shall have color coded zoning for each fan coil with indication of location of temperature sensor with link from colored zone to associated fan coil unit.

EXHAUST VAV CONTROL:

Each VAV shall be controlled to maintain exhaust CFM per schedule during occupied hours. It will be set to its minimum CFM at 0% during unoccupied hours.

DOMESTIC WATER BOOSTER PUMP:

The pressure transducer switch shall be set at 75psi (adj). When the system pressure drops below 70psi (adj) and the flow switch (FS) indicates flow, the booster pump shall soft start via VFD and run until the

pressure in the system reaches 75psi (adj) and VFD will adjust to maintain building constant pressure of 65psi (adj). The system pressures, flow and VFD operation shall be trended and displayed on the system graphics.

BUILDING POWER MONITORING:

Monitoring of the building main power and tenant power systems shall be accomplished through Wattnode BACnet MS/TP power meters as indicated on the mechanical and electrical plan schedules. Graphical displays shall indicate current power state as well as historical data per month. Data shall be arranged and reported in a format suitable for invoicing the building tenants for their monthly power usage. Provide minimum graphics/reports as noted below.

Graphic for each power meter being monitored to include:

Current meter representation of continuous kW.
Live continuous kW
Current Month Peak kW
Monthly Total kWh
Year Total kWh

Graphic and Report for each power meter to include:

Graphical table of monthly kWh for all months 1-12 including current and previous year information (similar to a power company billing)
Year to date total power consumption in kWh
Year to date total power consumption in kWh for previous year through current date

Each month, the electrical usage and peak shall be reset. DDC system to ensure that all previous month/year data is trended and stored for future history retrieval.

ELEVATOR PIT WATER DETECTION/ALARM:

Provide a BAPI rope-type water detection sensor to be mounted in the elevator pit to provide adequate coverage of the pit floor for detection of the presence of water accumulation or leakage into the pit.

SYSTEM REMOTE ALARM SETUP:

Initiate the following minimum alarms via text message or email for building operator staff:

DOAS Supply Fan Failure
DOAS Exhaust Fan Failure
DOAS Supply air temperature out of range for extended period
DOAS Gas Burner failure
High/Low Duct Static
High/Low Building Static
Domestic Water pressure out of range for extended period
Elevator Pit water detected

**SECTION 23 11 13
NATURAL GAS PIPING**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes piping, fittings, and valves.
- B. Related Sections:
 - 1. Section 22 05 29: Hangers and Supports.
 - 2. Section 22 05 23: Valves.
 - 3. Section 22 05 53: – Mechanical Identification: Product requirements for valve and pipe identification for placement by this section.

1.2 REFERENCES

- A. ASME Section IX (American Society of Mechanical Engineers) - Welding and Brazing Qualifications.
- B. ASME B16.3 (American Society of Mechanical Engineers) - Malleable Iron Threaded Fittings.
- C. ASME B31.2 (American Society of Mechanical Engineers) - Fuel Gas Piping.
- D. ASME B31.9 (American Society of Mechanical Engineers) - Building Service Piping.
- E. ASME B36.10 (American Society of Mechanical Engineers) - Welded and Seamless Wrought Steel Pipe.
- F. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.
- G. ASTM A234/A234M - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
- H. AWS D1.1 (American Welding Society)-Structural Welding Code.
- I. NFPA 54 (National Fire Protection Association) – National Fuel Gas Code.
- J. UL 1479 (Underwriters Laboratories, Inc.) - Fire Tests of Through-Penetration Firestops.

1.3 SUBMITTALS

- A. Submittals: Provide in accordance with the General Conditions of the Contract.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories. Submit manufacturers catalog information. Indicate valve data and ratings.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of valves, piping system, and system components.
- B. Operation and Maintenance Data: Submit installation instructions, spare parts lists.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 54 and local gas company jurisdiction standards.
- B. Perform Work in accordance with ASME B31.2, ASME B31.9 code for installation of piping systems and ASME Section IX for welding materials and procedures.
- C. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install underground piping when bedding is wet or frozen.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

- B.
 - A. Steel Pipe: ASTM A53 Schedule 40 black.
 - 1. Fittings: ASTM A234/A234M forged steel welding type.
 - 2. Joints: [ASME B31.1] [ASME B31.2] [ASME B31.9] [ASME Section 9], welded.
 - 3. Jacket: AWWA C105 polyethylene jacket or double layer, half-lapped 10 mil (0.25 mm) polyethylene tape.

2.2 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53 Schedule 40 black.
 - 4. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M forged steel welding type.
 - 5. Joints: NFPA 54, threaded or welded to ASME B31.2, ASME B31.9.

2.3 FLANGES, UNIONS, AND COUPLINGS

- A. Pipe Size 2 inches (50 mm) and Under:
 - 6. Ferrous pipe: 150 psi (1034 kPa) malleable iron threaded unions.
 - 7. Copper tube: 150 psi (1034 kPa) bronze unions with brazed joints.
- C. Pipe Size Over 2 inches (50 mm):
 - 1. Ferrous pipe: 150 psi (1034 kPa) forged steel slip-on flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.
 - 2. Copper tube: 150 psi (1034 kPa) slip-on bronze flanges; 1/16 inch (1.6 mm) thick preformed neoprene gaskets.

2.4 PIPE HANGERS AND SUPPORTS

- A. Conform ASME B31.2, ASME 31.9.
- B. Hangers for Pipe Sizes ½ to 1-1/2 inch (15 to 40 mm): Carbon steel, adjustable swivel, split ring.
- D. Hangers for Pipe Sizes 2 inches (50 mm) and Over: Carbon steel, adjustable, clevis.

- E. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- F. Wall Support for Pipe Sizes to 3 inches (80 mm): Cast iron hook.
- G. Vertical Support: Steel riser clamp.
- H. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

2.5 FIRE STOP SYSTEMS

- A. General Purpose Fire Stopping Sealant: Water based, non-slumping, premixed sealant with in tumescent properties, rated for 3 hours in accordance with ASTM E814 and UL 1479.
- B. General Purpose Vibration Resistant Fire Stopping Sealant: Silicone based, non-slumping, premixed sealant with in tumescent properties, vibration and moisture resistant, rated for 3 hours in accordance with ASTM E814 and UL 1479.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions

3.3 INSTALLATION

- A. Install natural gas piping in accordance with ASME B31.2.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install in accordance with NACE RP-01-69.
- C. Route piping in orderly manner and maintain gradient.
- D. Install piping to conserve building space and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.

- I. Where pipe support members are welded to structural building framing, scrape, brush clean, weld, and apply one coat of zinc rich primer.
- J. Provide support for utility meters in accordance with requirements of utility company.
- K. Pipe vents from gas pressure reducing valves to outdoors and terminate in weatherproof hood.
- L. Install identification on piping systems including underground piping. Refer to Section 22 05 53.
- M. Install valves with stems upright or horizontal, not inverted.
- N. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- O. Provide new gas service. Gas service distribution piping to have initial minimum pressure. As shown in the Drawings.

END OF SECTION

**SECTION 23 21 16
PIPING SPECIALTIES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes pressure gages and pressure gage taps, thermometers and thermometer wells, static pressure gages, filter gages. Section also includes, expansion tanks, air vents, air separators, strainers, pump suction fittings, combination fittings, flow indicators, controls, meters. Section also includes glycol specialties, pressure-reducing valves.
- B. Related Sections:
 - 1. Section 23 20 00 – Heating, Cooling, and Steam Piping: Execution requirements for piping connections to products specified by this section.

1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers) - Boiler and Pressure Vessel Codes, SEC VIII-D - Rules for Construction of Pressure Vessels.
- B. ASME B40.1 (American Society of Mechanical Engineers) - Gauges - Pressure Indicating Dial Type - Elastic Element.
- C. ASTM E1 - Standard Specification for ASTM Thermometers.
- D. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- E. ASTM A105 - Forgings, Carbon Steel, for Piping Components.
- F. ASTM A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.
- G. ASTM A216 - Steel Casings, Carbon, Suitable for Fusion Welding, for High Temperature Service.
- H. ASTM A395 - Ferric Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

1.3 SUBMITTALS

- A. Product Data: Submit for manufactured products and assemblies used in this Project as per the General Conditions of this Contract.
 - 1. Manufacturer's data indicating use, operating range, total range, accuracy, and location for manufactured components.
 - 2. Submit product description, model, dimensions, component sizes, service sizes, and finishes.
 - 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
 - 4. Submit electrical characteristics and connection requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of components and instrumentation, flow controls flow meters.
- C. Operation and Maintenance Data: Submit instructions for calibrating instruments, installation instructions, assembly views, servicing requirements, lubrication instruction, and replacement parts list as per the General Conditions of the Contract.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Protect systems from entry of foreign materials by temporary covers, caps and closures, completing sections of the work, and isolating parts of completed system until installation.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install instruments when areas are under construction, except rough in, taps, supports and test plugs.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements before fabrication.

1.8 MAINTENANCE SERVICE

- A. Execution Requirements: Maintenance service.
- B. Furnish bi-annual visit for one year starting from Date of Substantial Completion to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

1.9 EXTRA MATERIALS

- A. Provide sufficient inhibited propylene glycol to maintain specified concentrations for the one-year warranty period.

PART 2 PRODUCTS

2.1 PRESSURE GAGES

- A. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.
 - 1. Case: Cast Aluminum.
 - 2. Bourdon Tube: Brass.
 - 3. Dial Size: 4-1/2 inch (114 mm).
 - 4. Mid-Scale Accuracy: One.
 - 5. Scale: Both psi and kPa.

6. Verify maximum pressure to be read prior to installation.

2.2 PRESSURE GAGE TAPS

- A. Needle Valve:
 1. Brass, 1/4 inch (6 mm) NPT for minimum 300 psi (2070 kPa).
- B. Ball Valve:
 1. Brass, 1/4 inch (6 mm) NPT for 250 psi (1720 kPa).
- C. Pulsation Damper:
 1. Pressure snubber, brass with 1/4 inch (6 mm) NPT connections.

2.3 STEM TYPE THERMOMETERS

- A. Manufacturers: Weiss Instruments
- B. Thermometer: Vari-Angle Digital industrial glass thermometer that is self-powered.
 1. Case: Hi-impact ABS
 2. Range: -40 / 300°F
 3. Display: 3/8" LCD digits, wide ambient formula
 4. Accuracy: 1 percent of reading or 1°F whichever is greater
 5. Re-Calibration: Internal potentiometer
 6. Update: Every 10 seconds
 7. Resolution: 1/10° between -19.9 / 199.9°F
 8. Lux Rating: 10 Lux (one foot-candle)
 9. Sensor: Glass passivated thermistor
 10. Ambient Temp Error: Zero
 11. Stem Assemblies: Industrial Glass - Full conformance with Fed. Spec. GG-T-321D. Fully interchangeable with Industrial Glass Thermometers
 12. Model: DVS35

2.4 TEST PLUGS

- A. Manufacturers: Teriece, Fairfax, Peterson Equipment.
- B. 1/4 inch (6 mm) NPT or 1/2 inch (13 mm) NPT brass fitting and cap for receiving 1/8 inch (3 mm) outside diameter pressure or temperature probe with:
 1. Neoprene core for temperatures up to 200 degrees F (93 degrees C).
 2. Nordel core for temperatures up to 350 degrees F (176 degrees C).
 3. Viton core for temperatures up to 400 degrees F (204 degrees C).
 4. Extension for insulated pipe.
- C. Test Kit:
 1. Carrying case, internally padded and fitted containing:
 - a. One 2-1/2 inch (64 mm) diameter pressure gages.
 - 1) Scale range: 0 to 100 psi
 - b. One gage adapters with 1/8 inch (3 mm) probes.
 - c. Two 1-1/2 inch (38 mm) dial thermometers.
 - 1) Scale range: 30 to 240 degrees F.

2.5 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 150 psig

(1035kPa), with flexible EPDM diaphragm sealed into tank, and steel support stand. Pressure rating of the expansion tank for the domestic water booster pump is to be rated for a working pressure of 150 psig.

- B. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to 20 psig
- C. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure back flow prevention device, test cocks, strainer, vacuum breaker, and by-pass valves.
- D. Contractor is to provide & install a domestic hot water expansion tank on hot water heaters. Verify (if necessary) final size with mechanical engineer.
- E. Size: As Scheduled on the Drawings.

2.6 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
- B. Float Type:
 - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

2.7 AIR SEPARATORS

- A. Manufacturers: Bell and Crossett, Amtrol, Armstrong, Taco.
- B. Dip Tube Fitting:
 - 1. For 150 psig (860 kPa) operating pressure; to prevent free air collected in boiler from rising into system.
- C. In-line Air Separators:
 - 1. Cast iron for sizes 1-1/2 inch (40 mm) and smaller, or steel for sizes 2 inch (50 mm) and larger; tested and stamped in accordance with ASME SEC 8-D; for 150 psig (860 kPa) operating pressure.
- D. Combination Air Separators/Strainers:
 - 1. Steel, tested and stamped in accordance with ASME SEC 8-D; for 150 psig (860 kPa) operating pressure, with integral galvanized steel strainer, tangential inlet and outlet connections, and internal stainless steel air collector tube.
- E. Size: As scheduled in drawing.

2.8 STRAINERS

- A. Manufacturers: Armstrong, Itt, Keckley, Mueller, Metraflex, Victaulic, Gustin, and Bacon.
- B. Size 2 inch (50 mm) and Under:
 - 1. Screwed brass or iron body for 275 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm):
 - 1. Flanged iron body for 275 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.

- D. Size 5 inch (125 mm) and Larger:
 - 1. Flanged iron body for 275 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

2.9 FLOW METERS

- A. Manufacturers: Bell and Crossett, Lierand, Armstrong, Taco, Amtrol.
- B. Orifice type by-pass circuit with direct reading gage, soldered or flanged piping connections for 250 psig (860 kPa) working pressure, with shut off valves, and drain and vent connections.
- C. Direct reading with insert pitot tube, threaded coupling, for 250 psig (1034 kPa) working pressure, maximum 240 degrees F (115 degrees C), 5 percent accuracy.
- D. Cast iron, wafer type, orifice insert flow meter for 250 psig (1720 kPa) working pressure, with read-out valves equipped with integral check-valves and caps with gaskets.
- E. Calibrated, plug type balancing valve with precision-machined orifice, readout valves equipped with integral check valves and caps with gaskets, calibrated nameplate and indicating pointer.
- F. Cast iron or bronze, globe style, balancing valve with hand wheel with vernier type ring setting and memory stop, drain connection, readout valves equipped with integral check valves and caps with gaskets.

2.10 RELIEF VALVES

- A. Manufacturers: Kunkle, Watts, McDonnell & Miller.
- B. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.11 GLYCOL CHARGING

- A. Mixing Tank: 55 gallon poly tank & removable lid with pumps, isolation valves, check valves, pre-manuf. Wiring, fittings, etc. suitable for filling.
- B. Storage Tank: Closed type, welded steel constructed, tested and stamped in accordance with ASME SEC 8-D; 150 psi rating; cleaned, prime coated, and supplied with steel support saddles. Construct with taps for installation of accessories.

2.12 GLYCOL SOLUTION

- A. Inhibited propylene glycol and water solution mixed 35 percent glycol - 65 percent water. (As scheduled in drawing) See pump schedule for other requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- B. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
- C. Install gage taps in piping

- D. Install pressure gages with pulsation dampers.
- E. Provide needle valve or ball valve to isolate each gage. Extend nipples to allow clearance from insulation.
- F. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (64 mm) for installation of thermometer sockets. Allow clearance from insulation. Thermometers are to be installed on chilled water system at or near the chiller, on boiler system at or near both the boiler and secondary heating system, on domestic water system at or near the water heater, on the cold water entry, and on steam systems.
- G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- H. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
- I. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- J. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- K. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- L. Locate test plugs.
- M. Install auto air vents at system high points.
- N. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- O. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- P. Provide drain and hose connection with valve on strainer blow down connection.
- Q. Provide relief valves on pressure tanks, low-pressure side of reducing valves, heat exchangers, and expansion tanks.
- R. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- S. Pipe relief valve outlet to nearest floor drain.
- T. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- U. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set to fill at final field verified psi.

2.1 FIELD QUALITY CONTROL

- A. Test for strength of glycol and water solution and submit written test results.

2.2 CLEANING

- A. Clean and flush glycol system before adding glycol solution.

2.3 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not install hydronic and steam pressure gauges until after systems are pressure treated.

END OF SECTION

SECTION 23 21 23
PUMPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes in-line circulators, vertical in-line pumps, close-coupled pumps, and base mounted pumps.
- B. Related Sections:
 - 1. Section 23 20 00 – Heating and Cooling Piping: Execution requirements for connection to pumps specified by this section.

1.2 REFERENCES

- A. ASME (American Society of Mechanical Engineers) - Boiler and Pressure Vessel Codes, SEC VIII-D - Rules for Construction of Pressure Vessels.
- B. UL 778 (Underwriters Laboratories, Inc.) - Motor Operated Water Pumps.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.4 SUBMITTALS

- A. Submit product data in accordance with the General Conditions of this Contract.
- B. All submitted pumps must meet or exceed the performances listed on the schedule. If submitted pumps cannot meet the minimum scheduled requirements, then contractor shall purchase scheduled pumps at no additional cost to the owner.
- C. Product Data: Submit certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements. Submit also, manufacturer model number, dimensions, service sizes, and finishes.
- D. Manufacturer's Installation Instructions: Submit application, selection, and hookup configuration with pipe and accessory elevations. Submit hanging and support requirements and recommendations.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit installation instructions, servicing requirements, assembly views, lubrication instructions, and replacement parts list as per the General Conditions of this Contract.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 WARRANTY

- A. Furnish 1 year manufacturer warranty for pumps.

PART 2 PRODUCTS

2.1 SYSTEM LUBRICATED CIRCULATORS

- A. Manufacturers: Bell and Gossett, Grundfos, Armstrong, and Taco.
- B. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psig (965 kPa) maximum working pressure, 230 degrees F (110 degrees C) maximum water temperature.
- C. Casing: Bronze with flanged pump connections.
- D. Impeller, Shaft, Rotor: Stainless Steel.
- E. Bearings: Metal Impregnated carbon (graphite) and ceramic.
- F. Motor: Impedance protected, single speed.
- G. Performance: As scheduled on the Drawings.

2.2 IN-LINE CIRCULATORS

- A. Manufacturers: Bell and Gossett, Grundfos , Armstrong, and Taco.
- B. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psig (860 kPa) maximum working pressure.
- C. Casing: Cast iron, with flanged pump connections.
- D. Impeller: Bronze, Stamped brass or cast bronze, keyed to shaft.
- E. Bearings: Two, oil lubricated bronze sleeves.
- F. Shaft: Alloy or stainless steel with copper or bronze sleeve, integral thrust collar.
- G. Seal: Carbon rotating against stationary ceramic seat, 225 degrees F maximum continuous operating temperature.
- H. Performance: As scheduled on drawings.

2.3 VERTICAL IN-LINE PUMPS

- A. Manufacturers: Bell & Gossett, Grundfos, Armstrong, and Taco.

- B. Type: Vertical, single stage, close coupled, or horizontally split casing, for in-line mounting, for 175 psig (1200 kPa) working pressure.
- C. Casing: Cast steel, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- D. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
- E. Shaft: Carbon steel with stainless steel impeller cap screw and bronze sleeve.
- F. Shaft Sleeve: Aluminum bronze.
- G. Seal: Carbon rotating against stationary ceramic seat, 225 degrees F maximum continuous operating temperature.
- H. Performance: As scheduled on drawings.

2.4 CLOSE COUPLED PUMPS

- A. Manufacturers: Bell & Gossett, Grundfos , Armstrong, and Taco.
- B. Type: Horizontal shaft, single stage, close coupled, radial split casing, for 125 psig (860 kPa) maximum working pressure.
- C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
- D. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
- E. Shaft: Stainless steel.
- F. Seal: Carbon rotating against stationary ceramic seat, 225 degrees F maximum continuous operating temperature.
- G. Performance: As scheduled on drawings.

2.5 BASE MOUNTED PUMPS

- A. Manufacturers: Bell & Gossett, Grundfos , Armstrong, and Taco.
- B. Type: Horizontal shaft, single stage, direct connected, radial or horizontal split casing, for 125 psig (860 kPa) maximum working pressure.
- C. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
- D. Impeller: Bronze, fully enclosed, keyed to shaft.
- E. Bearings: Grease lubricated roller or ball bearings.
- F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.
- G. Seal: Carbon rotating against stationary ceramic seat, 225 degrees F maximum continuous operating temperature.

- H. Drive: Flexible coupling with coupling guard.
- I. Base plate: Cast iron or fabricated steel with integral drain rim.
- J. Performance: As scheduled on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install Work in accordance with State standards.
- B. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over. Refer to Section 15070.
- C. Provide line sized shut-off valve and strainer or pump suction fitting on pump suction, and line sized soft seat check valve and balancing valve combination pump discharge valve on pump discharge.
- D. Provide air cock and drain connection on horizontal pump casings.
- E. Provide drains for bases and seals.
- F. Check, align, and certify alignment of base mounted pumps prior to start-up.
- G. Install close coupled and base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03300.
- H. Lubricate pumps before start-up.
- I. Provide side-stream filtration system for heating water, chilled water, and glycol systems. Install across pump with flow from pump discharge to pump suction from pump taps.

3.2 FIELD QUALITY CONTROL

- A. Execution Requirements: Testing, adjusting, and balancing.
- B. Inspect for alignment of base mounted pumps.

END OF SECTION

**SECTION 23 23 00
REFRIGERANT PIPING**

GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to Work of this section.

1.2 WORK INCLUDED

- A. The Contractor shall furnish all labor, material and equipment called for in these Specifications and accompanying Drawings and shall install the system complete in every respect. Work shall include but not be limited to the following:
 - 1. Pipes, tubing, fittings and specialties.
 - 2. Special duty valves.
 - 3. Refrigerants.

1.3 SUBMITTALS

- A. Product data for the following products:
 - 1. Each type valve specified.
 - 2. Each type refrigerant piping specialty specified.
- B. Shop Drawings showing layout of refrigerant piping, specialties, and fittings including, but not necessarily limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and proximate to equipment.

1.4 QUALITY ASSURANCE

- A. Qualify brazing processes and brazing operators in accordance with ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications".
- B. Regulatory Requirements: Comply with provisions of the following codes:
 - 1. ANSI B31.5: ASME Code for Pressure Piping - Refrigerant Piping.
 - 2. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
 - 3. BOCA Basic National Mechanical Code.

PART 2 - PRODUCTS

2.1 TUBING AND FITTING

- A. Copper Tubing: ASTM B 280, Type ACR, hard-drawn straight lengths, and soft-annealed coils, seamless copper tubing. Tubing shall be factory cleaned, ready for installation, and have ends capped to protect cleanliness of pipe interiors prior to shipping.
- B. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.

2.2 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (Silver).

2.3 VALVES

- A. General: Complete valve assembly shall be UL-listed and designed to conform to ARI 760.
- B. Globe: 450 psig maximum operating pressure, 275 deg. F maximum operating temperature; cast bronze body, with cast bronze or forged brass wing cap and bolted bonnet; replaceable resilient seat disc; plated steel stem. Valve shall be capable of being repacked under pressure. Valve shall be straight through or angle pattern, with solder-end connections.

- C. Check Valves - Smaller Than 7/8 inch: 500 psig maximum operating pressure, 300 deg. F maximum operating temperature; cast brass body, with removable piston, Teflon seat, and stainless steel spring; straight through globe design. Valve shall be straight through pattern, with solder-end connections.
- D. Solenoid Valves: 250 deg. F temperature rating, 400 psig working pressure; forged brass, with Teflon valve seat, two-way straight through pattern, and solder end connections. Provide manual operator to open valve. Furnish complete with NEMA 1 solenoid enclosure with 1/2-inch conduit adapter, and 24 volt, 60 Hz. normally closed holding coil.
- E. Evaporator Pressure Regulating Valves: pilot-operated, forged brass or cast bronze; complete with pilot operator, stainless steel bottom spring, pressure gage tappings, 24 volts DC, 50/60 Hz, standard coil; and wrought copper fittings for solder end connections.
- F. Thermal Expansion Valves: thermostatic adjustable, modulating type; size as required for specific evaporator requirements, and factory set for proper evaporator superheat requirements. Valves shall have copper fittings for solder end connections; complete with sensing bulb, a distributor having a side connection for hot gas bypass line, and an external equalizer line.
- G. Hot Gas Bypass Valve: adjustable type, sized to provide capacity reduction beyond the last step of compressor unloading; and wrought copper fittings for solder end connections.

2.4 REFRIGERANT PIPING SPECIALTIES

- A. General: Complete refrigerant piping specialty assembly shall be UL-listed and designed to conform to ARI 760.
- B. Strainers: 500 psig maximum working pressure; forged brass body with monel 80-mesh screen, and screwed cleanout plug; Y-pattern, with solder end connections.
- C. Moisture/liquid Indicators: 500 psig maximum operation pressure, 200 deg. F maximum operating temperature; forged brass body, with replaceable polished optical viewing window, and solder end connections.
- D. Filter-driers: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter-drier core kit, including gaskets, as follows:
 - 1. Standard capacity desiccant sieves to provide micronic filtration.
 - 2. High capacity desiccant sieves to provide micronic filtration and extra drying capacity.
- E. Suction Line Filter-Drier: 350 psig maximum operation pressure, 225 deg. F maximum operating temperature; steel shell, and wrought copper fittings for solder end connections. Permanent filter element shall be molded felt core surrounded by a desiccant. For removal of acids and moisture for refrigerant vapor.
- F. Suction Line Filters: 500 psig maximum operation pressure; steel shell, flange ring, and spring, ductile iron cover plate with steel capscrews, and wrought copper fittings for solder end connections. Furnish complete with replaceable filter core kit, including gaskets.
- G. Flexible Connectors: 500 psig maximum operating pressure; seamless tin bronze or stainless steel core, high tensile bronze braid covering, solder connections, and synthetic covering; dehydrated, pressure tested, minimum 7 inch in length.

2.5 REFRIGERANT

- A. Refrigerant No. 22, in accordance with ASHRAE Standard 34.

2.6 PIPE APPLICATIONS

- A. Use Type ACR drawn copper tubing with wrought copper fittings and brazed joints above ground, within building. Use Type K, annealed temper copper tubing for 2 inch and smaller without joints, below ground and within slabs. Mechanical fittings (crimp or flair) are not permitted.

PART 3 - EXECUTION

3.1 PIPING INSTALLATIONS

- A. General: Install refrigerant piping in accordance with ASHRAE Standard 15 - "The Safety Code for Mechanical Refrigeration."
- B. Install piping in as short and direct arrangement as possible to minimize pressure drop.
- C. Install piping for minimum number of joints using as few elbows and other fitting as possible.
- D. Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.
- E. Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.
- F. Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.
 - 1. Do not install insulation until system testing has been completed and all leaks have been eliminated.
- G. Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.
- H. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- I. Slope refrigerant piping as follows:
 - 1. Install horizontal hot gas discharge piping with 1/2" per 10 feet downward slope away from the compressor.
 - 2. Install horizontal suction lines with 1/2 inch per 10 feet downward slope to the compressor, with no long traps or dead ends which may cause oil to separate from the suction gas and return to the compressor in damaging slugs.
 - 3. Install traps and double risers where indicated, and where required to entrain oil in vertical runs.
 - 4. Liquid lines may be install level.
- J. Use fittings for all changes in direction and all branch connections.
- K. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- L. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- M. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- N. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.
- O. Locate groups of piper parallel to each other, spaced to permit applying insulation and servicing of valves.
- P. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inch and larger shall be sheet metal.
- Q. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, and floors, maintain the fire rated integrity. Refer to Division 7 for special sealers and materials.
- R. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- S. Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

- T. Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.
 - 1. Install moisture/liquid indicators in lines larger than 2-1/8 inch OD, using a bypass line.
- U. Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.
- V. Install flexible connectors at the inlet and discharge connection of compressors.

3.2 HANGERS AND SUPPORTS

- A. General: Hanger, supports, and anchors are specified in Division 15 Section "SUPPORTS AND ANCHORS." Conform to the table below for maximum spacing of supports:
- B. Install the following pipe attachments:
- C. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.
- D. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
- E. Pipe rollers complete supports for multiple horizontal runs, 20 feet or longer supported by a trapeze.
- F. Spring hangers to support vertical runs.
- G. Install hangers with the following minimum rod sizes and maximum spacing:

<u>Nom. Pipe Size</u>	<u>Max. Span-Ft.</u>	<u>Min. Rod Size Inches</u>
1	7	3/8
1-1/2	9	3/8
2	10	3/8
3	12	1/2
3-1/2	13	1/2
4	14	5/8
5	16	5/8
6	17	3/4
8	19	7/8
10	22	7/8
12	23	7/8

- H. Support vertical runs at each floor.

3.3 PIPE JOINT CONSTRUCTION

- A. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - 1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
 - 2. CAUTION: When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant specialties before brazing. Do not apply heat near the bulb of the expansion valve.
- B. Fill the pipe and fittings during brazing, with an inert gas (ie., nitrogen or carbon dioxide) to prevent formation of scale.
- C. Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

3.4 VALVE INSTALLATIONS

- A. General: Install refrigerant valves where indicated, and in accordance with manufacturer's instructions.
- B. Install globe valves on each side of strainers and driers, in liquid and suction lines at evaporators, and elsewhere as indicated.
- C. Install a full sized, 3-valve bypass around each drier.

- D. Install solenoid valves ahead of each expansion valve and hot-gas bypass valve. Install solenoid valves in horizontal lines with coil at the top.
 - 1. Electrical wiring for solenoid valves is specified in Division 16. Coordinate electrical requirements and connections.
- E. Thermostatic expansion valves may be mounted in any position, as close as possible to the evaporator.
 - 1. Where refrigerant distributors are used, mount the distributor directly on the expansion valve outlet.
 - 2. Install the valve in such a location so that the diaphragm case is warmer than the bulb.
 - 3. Secure the bulb to a clean, straight, horizontal section of the suction line using two bulb straps. Do not mount bulb in a trap or at the bottom of the line.
 - 4. Where external equalizer lines are required make the connection where it will clearly reflect the pressure existing in the suction line at the bulb location.
- F. Install pressure regulating and relieving valves as required by ASHRAE Standard 15.

3.5 EQUIPMENT CONNECTIONS

- A. The Drawings indicate the general arrangement of piping, fittings, and specialties.
Install piping adjacent to machine to allow servicing and maintenance.

3.6 FIELD QUALITY CONTROL

- A. Inspect, test, and perform corrective action of refrigerant piping in accordance with ASME Code B31.5, Chapter VI.
- B. Repair leaking joints using new materials, and retest for leaks.

3.7 COMMISSIONING

- A. Charge system using the following procedure:
 - 1. Install core in filter dryer after leak test but before evacuation.
 - 2. Evacuate refrigerant system with vacuum pump; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
 - 3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
 - 4. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
 - 5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
 - 6. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

END OF SECTION

SECTION 23 25 00
CHEMICAL WATER TREATMENT EQUIPMENT

PART 1

PART 2 GENERAL

2.1 SUMMARY

- A. Section includes installation, pre start up, flushing and cleaning of piping systems, chemical feeder equipment including blow down & bleed off systems, and chemical treatment with associated piping fittings, feeders, pumps, tanks, controls, control wiring, motors, starters, meters and valves.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.
- C. General: The chemical water treatment system to be provided under these plans and specifications shall be a complete system and shall be supplied by Power Engineering Co., Superior Water, or Alpine Technical Services. Other water treatment companies may submit prior approval to engineer along with history of similar projects. The chemical supplier shall supply field supervision for the pre-start-up, flushing and cleaning of all equipment and field supervision for the installation of feeders and equipment. The contractor shall install or arrange to have installed all required chemical feeding equipment including blow down and bleed off systems and all necessary (and associated) piping, valves, fittings, control wiring, motors, and starters.

2.2 SUBMITTALS

- A. Submittals: Provide in accordance with the General Conditions of the Contract.
- B. Shop Drawings: Indicate system schematic, equipment locations, electrical characteristics and connection requirements.
- C. Product Data: Submit chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit placement of equipment in systems, piping configuration, and connection requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Manufacturers Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- G. Technical Data: submit shop drawings and product data for the following items in accordance with the General Conditions of the contract: Water Treatment Materials and Equipment, Control Diagrams, and Chemical & Quality provided.
- H. Operating Instructions and Maintenance Data: Submit printed Operating Instructions and Maintenance Data for the following items:
 - 1. All Water treatment Materials and Equipment
 - 2. Control Diagrams
 - 3. Water Treatment Program Control Chart.

2.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
- B. Operation and Maintenance Data: Submit data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step-by-step instructions on test procedures including target concentrations.
- C. If the contractor's warranty period extends beyond one year from chemical feed equipment start-up, the contractor shall negotiate an additional service retainer to cover the remainder of the warranty period.

PART 3 PRODUCTS

3.1 SYSTEM CLEANER

- A. Product Description: Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products.

3.2 CLOSED SYSTEM TREATMENT (CHILLED AND HEATING WATER SYSTEM – if applicable))

- A. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
- B. Provide & Install equipment & materials for cleaner, treatment, and dual glycol feeder.
- C. Corrosion inhibitors; liquid boron-nitrite. Plus an azole inhibitor treatment for the prevention of corrosion in closed system at 700 ppm total nitrite level.

3.3 COOLING TOWER PRODUCTS (if applicable)

- A. Provide & Install equipment and materials for all cooling towers.
- B. Cleaner, treatment, & Bio-Cide.

3.4 FEED & BLEED EQUIPMENT

3.5 BY-PASS (POT) FEEDER

- A. 5.0 gal quick opening cap with ¾" bypass drain valve for working pressure of 175 psig.

3.6 HEATING WATER SYSTEM (if applicable)

- 1. Equipment:
 - a. To be mounted as per drawings.
 - b. One (1) Neptune Model DBF-5, 5 gallon Bypass Feeder for each system.

3.7 GLYCOL WATER SYSTEMS (if applicable)

- A. Chemicals:
 - 1. Liquid Cleaner
 - 2. Huntsman Inhibited Propylene Glycol, 250° F maximum temperature.
 - 3. Liquid Alkaline dispersant cleaner to remove oil and foreign matter from the system prior to start-up.
- B. Equipment:

1. 55 gallon polyethylene mixing tank with tank mounted, 1/3 HP 120/1/60, electric motor driven gear pump, low level switch to activate audible alarm and lock-out glycol feed pump, integral Nema 4X control panel with H-O-A switch, adjustable pressure switch and connecting tubing and y-strainer in pump suction as shown in contract drawings.

3.8 POTABLE WATER SYSTEM (DISINFECTION)

1. Prior to utilization, new and/or repaired potable water systems shall be purged of deleterious matter and disinfection per IPC.
 - a. Flush with clean, potable water until dirty water does not appear at the points of outlet.
 - b. The system shall be filled with a water/chlorine solution containing not less than 50 ppm of chlorine, and the system shall be valved off and allowed to stand for 24 hours; or the system shall be filled with a water/chlorine solution containing not less than 200 ppm of chlorine and allowed to stand for 3 hours.
 - c. Once item b is complete, flush system with clean potable water until the chlorine is purged from the system.
 - d. Water Treatment Contractor is to publish a report of disinfection to T & B Contractor and mechanical engineer. Repeat procedure where shown by bacterial exam that contamination remains present in the system.

PART 4 EXECUTION

4.1 PREPARATION

- A. Operate, fill, start and vent systems prior to cleaning. Use water meter to record capacity in each system. Place terminal control valves in open position during cleaning.

4.2 CLEANING

- A. Concentration:
 1. Cleaning shall be performed by the Contractor under the supervision of the chemical supplier at the time of start-up. The system shall be filled with water and checked for leakage and debris. Add the proper dosage of liquid alkaline cleaner and circulate for 48 hours at the required temperature. Drain and flush piping – clean the strainers. Flush the system until the pH is no more than eight (8.0).
- B. Hot Water / Condenser Water Systems:
 1. Apply heat while circulating, slowly raising temperature to 120 degrees F (71 degrees C) and maintain for 12 hours minimum.
 2. Remove heat and circulate to 100 degrees F (37.8 degrees C) or less; drain systems as quickly as possible and refill with clean water.
 3. Circulate for 6 hours at design temperatures, then drain.
 4. Refill with clean water and repeat until system cleaner is removed.
 5. The system shall be filled with water and checked for leakage and debris. Add the proper dosage of Liquid Alkaline Cleaner and circulate for 48 hours at the required temperature. Drain and flush piping. Clean the strainers. Flush until system pH is no more than eight.
 6. Clean all strainers at conclusion of system cleaning.
- C. Glycol Water Systems:

1. Cleaning shall be performed by the Contractor at the time of start-up. The system shall be filled with water and checked for leakage and debris. Add the proper dosage of Liquid Cleaner and circulate for 48 hours at the required temperature. Drain and flush piping. Clean the strainers. Flush until system pH is no more than eight.
 2. Clean all strainers at conclusion of system cleaning.
- D. Control: Charge system with glycol/soft water mixture as designated in the contract drawings.
- E. Use neutralizer agents on recommendation of system cleaner supplier and acceptance of Architect/Engineer.
- F. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.
- G. Remove pre-construction strainer, clean, and replace with operating strainer screens.
- H. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
- I. Circulate for 24 hours with cleaner. Start a bleed with city water to make a closed system. Maintaining working psi. (Typical of both heating and chilled system.)

4.3 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system. Install isolating and drain valves and interconnecting piping. Install around balancing valve downstream of circulating pumps.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.

END OF SECTION

**SECTION 23 31 00
DUCTS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes metal ductwork, nonmetallic ductwork, casing and plenums, buried ductwork, kitchen hood ductwork, duct cleaning.
- B. Related Sections:
 - 1. Section 220529 – Hangers and Supports: Product requirements for hangers, supports and sleeves for placement by this section.

1.2 REFERENCES

- A. ASTM A36 - Structural Steel.
- B. ASTM A90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
- C. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.
- E. ASTM A568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- F. ASTM A569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.
- G. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- H. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.
- I. NFPA 90B (National Fire Protection Association) - Installation of Warm Air Heating and Air Conditioning Systems.
- J. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Air Duct Leakage Test Manual.
- K. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- L. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - Fibrous Glass Duct Construction Standards.
- M. UL 181 (Underwriters Laboratories, Inc.) - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. Size No round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.4 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- C. Manufacturer's Installation Instructions: Submit special procedures for glass fiber ducts.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A and NFPA 90B standards.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

1.8 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.9 WARRANTY

- A. Furnish 1 year manufacturers warranty for ducts.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90.
- B. Steel Ducts: ASTM A366 A569 A568.

- C. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061- T6 or of equivalent strength.
- D. Fasteners: Rivets, bolts, or sheet metal screws.
- E. Hanger Rod: ASTM A36; steel, galvanized threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings. Furnish duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, furnish turning vanes of perforated metal with glass fiber insulation.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Provide standard 45-degree lateral wye takeoffs. When space does not allow 45-degree lateral wye takeoff, use 90-degree conical tee connections.
- F. Radius elbows shall be used in lieu of 90's with turning vanes. If there is any conflict on the plans, coordinate with engineer prior to construction.
- G. All high pressure take-off's from the shaft shall have high efficiency take-off's. All low pressure take-off's shall have HET's.

2.3 Insulated Flexible Ducts:

- A. Manufacturers: Flex Master
- B. When using flexible duct, contractor is to install rigid duct with a 90° elbow facing down, then install flex duct vertically from the 90° elbow to the grille or register. There are cases where this is not possible and we understand this.
- C. Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; polyethylene aluminized vapor barrier film.
 - 1. Pressure Rating: 10 inches wg (2.50 kPa) positive and 1.0 inches wg (250 Pa) negative.
 - 2. Maximum Velocity: 4000 fpm (20.3 m/sec).
 - 3. Temperature Range: -10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C).

2.4 GLASS FIBER DUCTS

- A. Fabricate in accordance with SMACNA Fibrous Glass Duct Construction Standards, except as indicated on Drawings. (Return air boots and transfer ducts only).
- B. Pressure sensitive tape, UL approved. 2 inch (50mm) wide pressure sensitive tape, UL approved.
- C. Machine-fabricate glass fiber ducts and fittings. Make only minor on site manual adjustments.
- D. Staple duct joints and tape with 3 inch (75 mm) wide 2 mil (0.05) thick or 2 inch (50 mm) wide 3 mil (0.75 mm) thick aluminum.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01300 - Administrative Requirements: Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install glass fiber ducts in accordance with SMACNA Fibrous Glass Duct Construction Standards. Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.
- C. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Use crimp joints with or without bead or beaded sleeve couplings for joining all round ducts.
- E. Use double nuts and lock washers on threaded rod supports.
- F. Connect flexible ducts to metal ducts with draw bands. Maximum flex duct length 4'.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage. Where openings are provided in insulated ductwork, install insulation material inside metal ring.
- B. Connect terminal units to supply ducts directly. Do not use flexible duct to change direction.

3.4 CLEANING

- A. Section 01700 - Execution Requirements: Final cleaning.
- B. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air flow, clean one half of system completely before proceeding to other half. Protect equipment with potential to be harmed by excessive dirt with temporary filters, or bypass during cleaning.

3.5 SCHEDULES

DUCTWORK MATERIAL SCHEDULE

AIR SYSTEM	MATERIAL
Supply (Heating Systems)	Galvanized Steel, Aluminum
Supply (System with Cooling Coils)	Galvanized Steel, Aluminum
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Transfer Air and Sound Boots	Fibrous Glass Duct.

END OF SECTION

SECTION 23 32 00
DUCT AIR LEAKAGE TESTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes roadmap to successful duct air leakage testing.
- B. Related Sections:
 - 1. Section 23 31 00: Ducts
 - 2. Section 23 33 00: Duct accessories.

1.2 REFERENCES

- A. AABC National Standard
- B. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Air Duct Leakage Test Manual.
- C. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- D. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - Fibrous Glass Duct Construction Standards.
- E. ASHRAE Fundamentals Handbook – current edition.
- F. UL 181 (Underwriters Laboratories, Inc.) - Factory-Made Air Ducts and Connectors.

1.3 PERFORMANCE REQUIREMENTS

- A. This specification applies to the Office Building, DOAS duct, MAU duct serving the future restaurants, grease exhaust ducts serving the future restaurants, and RTU main supply & return duct.
- B. Engineer is to specify the test pressure that does not exceed the pressure rating of the duct construction.
- C. Engineer is to specify the system's maximum allowable duct leakage percentage.
- D. The Mechanical Contractor shall:
 - 1. Prepare the duct / air handler section(s) to be tested.
 - 2. Provide connections for duct leakage test apparatus.
 - 3. Pre-test the system prior to scheduling the air balance agency testing to prevent failed tests and schedule delays.
 - 4. Take corrective action to seal the ducts when the maximum allowable leakage rate is exceeded.
 - 5. Allow sealant enough curing time before any duct pressurization.
- E. The Air Balance Agency shall report:
 - 1. The date of the test.
 - 2. The name and phase of the project.

3. A complete description of the ductwork tested, including location, sealing classification, and duct classification.
4. The test design static pressure and the actual test static pressure.
5. The test design maximum allowable leakage rate and the actual leakage rate.
6. The calculation of the duct test section maximum allowable leakage rate.
7. The tested result, "pass" or "fail".
8. The orifice size, manufacturer, orifice tube serial #, and calibration date.
9. The actual orifice pressure differential and the actual airflow.
10. The name of the technician performing the test and any other inspectors or engineers witnessing the tests.

1.4 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.
- C. All duct (supply, return, exhaust) is to be tested under a positive test pressure. ASHRAE/SMACNA/TIMA 1985, Swim and Griggs 1995 have confirmed that longitudinal seam, transverse joint, and assembled duct leakage can be represented from equation (1) and that for the same construction, leakage is not significantly different in the negative and positive modes.
 1. Equation (1): $Q = C\Delta p_s^N$
 2. Q = duct leakage rate.
 3. C = constant reflecting area characteristics of leakage path.
 4. Δp_s = static pressure differential from duct interior to exterior, in H_2O .
 5. N = exponent relating turbulent or laminar flow in leakage path.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: See 1.3, E.

1.6 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Perform work in accordance with AABC National Standards.
- C. With no significant difference in leakage rate results, PVE, Inc. requests to always tests all duct and under a positive pressure. A positive pressure allows the use of smoke or wave of your hand across duct connections to identify leaks. Under negative pressure, the identification or areas of leakage is much more difficult, more time consuming, and almost impossible at times.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

PART 2 PRODUCTS

2.1 TEST CRITERIA

- A. The supply air & return air main ducts are to be pressurized to 1½ times the design fan static pressure with 1% of the system total design CFM as the maximum allowable leakage rate. Test all floors of the building and all duct loops on all floors. Each floor is to be tested independently and documented for each floor.
- B. Exhaust air main ducts are to be pressurized to 1½ times the fan design static pressure with 2% of the system total design CFM as the maximum allowable leakage rate.

2.2 TEST SECTIONS AND PRE-TEST

- A. Mechanical contractor may elect to separate the systems into sections such as risers, shafts, loops per floor, etc.
- B. Mechanical contractor should pre-test each section prior to any air balance agency testing, inspector witnessing, mechanical engineer witnessing, duct insulation installation, duct shafts are closed up, or any other structural construction that will have an impact is continued.

PART 3 RESULTS

3.1 CONCLUSION

- A. For a medium or high pressure design (2" W.G. and up) SMACNA specifies that: "Total allowable leakage should not exceed 1% of the total system design air flow rate." However, comparisons have shown that leakage rates greater than 1% reflects a 39% annual increase to operate the fans.
- B. United McGill maintains that a quality fabricated duct system, properly installed and sealed, should achieve leakage rates as low as 0.5% of 1%. Since the power required to operate HVAC RTU's and MAU's is normally the largest contributor to building energy costs, every effort should be made to reduce this expenditure.

END OF SECTION

**SECTION 23 33 00
DUCT ACCESSORIES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes back-draft dampers, combination fire-and-smoke dampers, duct access doors, fire dampers, smoke dampers, volume control dampers, flexible duct connections and duct test holes.
- B. Related Sections:
 - 1. Electrical - Wiring Devices: Execution requirements for connection of electrical Combination Smoke and Fire Dampers specified by this section.
 - 2. Section 230900 - HVAC Instrumentation: Execution and Product requirements for connection and control of Combination Smoke and Fire Dampers for placement by this section.

1.2 REFERENCES

- A. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilating Systems.
- B. NFPA 92A (National Fire Protection Association) - Smoke Control Systems.
- C. SMACNA (Sheet Metal Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- D. UL 33 (Underwriters Laboratories, Inc.) - Heat Responsive Links for Fire-Protection Service.
- E. UL 555 (Underwriters Laboratories, Inc.) - Fire Dampers and Ceiling Dampers.
- F. UL 555S (Underwriters Laboratories, Inc.) - Leakage Rated Dampers for Use in Smoke Control Systems.

1.3 SUBMITTALS

- A. Provide in accordance with the General conditions of the Drawings.
- B. Product Data: Submit data for shop fabricated assemblies including volume control dampers duct access doors and hardware used. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Submit for Fire and Combination Smoke and Fire Dampers.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01700 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of access doors and test holes.

- C. Operation and Maintenance Data: Submit for Combination Smoke and Fire Dampers.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.7 COORDINATION

- A. Coordinate Work where appropriate with building control Work.

PART 2 PRODUCTS

2.1 COMBINATION FIRE AND SMOKE DAMPERS

- A. Fabricate in accordance with NFPA 90A, UL 555, and UL 555S.
- B. Multiple-Blade Dampers: Fabricate with 16 gage (1.5 mm) galvanized steel frame and blades. Furnish oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.
- C. Operators: UL listed and labeled spring return electric type suitable for 120 volts, single phase, 60 Hz. Furnish end switches to indicate damper position. Locate damper operator on interior or exterior of duct and link to damper operating shaft.
- D. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of Electro thermal link, flexible stainless steel blade edge seals to produce constant sealing pressure.
- E. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of Electro thermal link, flexible stainless steel blade edge seals to produce constant sealing pressure, stainless steel springs with locking devices to maintain positive closure for units mounted horizontally.
- F. Electro Thermal Link: Fusible link melting at 165 degrees F; 120 volts, single phase, 60 Hz; UL listed and labeled.

2.2 DUCT ACCESS DOORS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Fabrication: Rigid and close fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, furnish minimum 1 inch (25 mm) thick insulation with sheet metal cover.
 - 1. Less Than 12 inches (300 mm) square, secure with sash locks.
 - 2. Up to 18 inches (450 mm) Square: Furnish two hinges and two sash locks.

3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches with outside and inside handles.
4. Larger Sizes: Furnish additional hinge.
5. Access panels with sheet metal screw fasteners are not acceptable.

2.3 FIRE DAMPERS

- A. Fabricate in accordance with NFPA 90A and UL 555, and manufacturer's condition of listing. Permanently mark dampers for use in static systems.
- B. Horizontal Dampers: Galvanized steel, 22 gage (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- C. Curtain Type Dampers: Galvanized steel with interlocking blades. Furnish stainless steel closure springs and latches for horizontal installations conditions. Configure with blades out of air stream except for 1.0-inch 250 Pa pressure class ducts up to 12 inches (300 mm) in height.
- D. Multiple Blade Dampers: 16 gage (1.5 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.
- E. Fusible Links: UL 33, separate at 160 with adjustable link straps for combination fire/balancing dampers.

2.4 VOLUME CONTROL DAMPERS.

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized frame channel with suitable hardware.
- C. End Bearings: Except in round ductwork 12 inches and smaller, furnish end bearings. On multiple blade dampers, furnish oil-impregnated nylon or sintered bronze bearings. Furnish closed end bearings on ducts having pressure classification over 2 inches wg.
- D. Quadrants:
 1. Furnish locking, indicating quadrant regulators on single and multi-blade dampers.
 2. On insulated ducts mount quadrant regulators on standoff mounting brackets, bases, or adapters.
 3. Where rod lengths exceed 30 inches (750 mm) furnish regulator at both ends.

2.5 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
- B. Connector: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric conforming to NFPA 90A, minimum density **30 oz per sq yd.**
2. Net Fabric Width: Approximately **3 inches** wide.
3. Metal: **3 inch** wide, **24 gage** galvanized steel.

2.6 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Furnish extended neck fittings to clear insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify rated walls are ready for fire damper installation.
- B. Verify ducts and equipment installation are ready for accessories.

3.2 INSTALLATION.

- A. Install in accordance with NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 233100 for duct construction and pressure class.
- B. Install duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and as indicated on Drawings. Install minimum **8 x 8 inch (200 x 200 mm)** size for hand access, **18 x 18 inch (450 x 450 mm)** size for shoulder access, and as indicated on Drawings. Install **4 x 4 inch (100 x 100 mm)** for balancing dampers only. Review locations prior to fabrication.
- C. Install duct test holes required for testing and balancing purposes.
- D. Provide fire dampers, combination fire and smoke dampers at locations as indicated on Drawings. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- E. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92A.

3.3 DEMONSTRATION AND TRAINING

- A. Demonstrate re-setting of fire dampers to Owner's representative.

END OF SECTION

SECTION 23 34 00
FANS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes roof exhausts fans, cabinet fans, ceiling exhaust fans, backward inclined centrifugal fans, forward curved centrifugal fans, airfoil centrifugal fans, radial centrifugal fans, tubular centrifugal fans, in-line centrifugal fans, vent sets, vane axial fans, propeller fans, motors, drives and accessories.
- B. Related Sections:
 - 1. Section 220548 – Mechanical Sound, Vibration, and Seismic Control: Product requirements for resilient mountings and snubbers for fans for placement by this section.
 - 2. Section 220700 – Mechanical Insulation: Product requirements for power ventilators for placement by this section.
 - 3. Section 233100 - Ducts: Product requirements for hangers for placement by this section.
 - 4. Section 233300 - Duct Accessories: Product requirements for Back-draft Dampers for placement by this section.

1.2 REFERENCES

- A. ABMA STD 9 (American Boiler Manufacturers Association) - Load Ratings and Fatigue Life for Ball Bearings.
- B. ABMA STD 11 (American Boiler Manufacturers Association) - Load Ratings and Fatigue Life for Roller Bearings.
- C. AMCA 99 (Air Movement and Control Association) - Standards Handbook.
- D. AMCA 210 (Air Movement and Control Association) - Laboratory Methods of Testing Fans for Rating.
- E. AMCA 300 (Air Movement and Control Association) - Reverberant Room Method for Sound Testing of Fans.
- F. AMCA 301 (Air Movement and Control Association) - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- G. NEMA MG1 (National Electrical Manufacturers Association) - Motors and Generators.
- H. UL 705 (Underwriters Laboratories, Inc.) - Power Ventilators.

1.3 SUBMITTALS

- A. Section 23 00 15.
- B. Shop Drawings: Indicate size and configuration of fan assembly, mountings, weights, ductwork, and accessory connections.

- C. Product Data: Submit data on fans and accessories including fan curves with specified operating point plotted, power, RPM, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
- D. Test Reports: Indicate performance data for adjustable axial fan blades for at least five blade settings, including maximum.
- E. Manufacturer's Installation Instructions: Submit fan manufacturers instructions.
- F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing. Work of this section with minimum three years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect motors, shafts, and bearings from weather and construction dust.

1.7 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate fans for until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.8 WARRANTY

- B. Furnish 1 year manufacturer warranty for fans.

1.9 MAINTENANCE SERVICE

- A. Execution Requirements: Maintenance service
- B. Furnish service and maintenance of fans for one year from Date of Substantial Completion.

1.10 EXTRA MATERIALS

- A. Furnish one set of belts for each fan.

PART 2 PRODUCTS

2.1 CENTRIFUGAL FANS (Class Fans)

- A. Manufacturers:

1. Greenheck
 2. Twin City
 3. Barry Blower
- B. Performance
1. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
 2. Sound Ratings: AMCA 301, tested to AMCA 300 and bear AMCA Certified Sound Rating Seal.
 3. Fabrication: Conform to AMCA 99
 4. Performance Base: 4200 feet conditions.
 5. Temperature Limit: Maximum 300 degrees F (150 degrees C).
 6. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.
- C. Wheel and Inlet
1. Backward Inclined: Steel or aluminum construction with smooth curved inlet flange, back plate, backward curved blades welded or riveted to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
 2. Forward Curved: Black enamel steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.
 3. Airfoil Wheel: Steel construction with smooth curved inlet flange, back plate die formed hollow airfoil shaped blades continuously welded at tip flange, and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.
 4. Radial: Steel construction with inlet flange back plate, plate blades with reinforcing gussets and wearing strips welded or riveted to back plate and keyed to shaft with set screws.
- D. Housing
1. Steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, braced, designed to minimize turbulence with spun inlet bell and shaped cut-off.
 2. Bolted construction with horizontal split housing.
 3. Fabricate plug fans without volute housing, in lined steel cabinet.
- E. Bearings and Sleeves
2. Bearings: pillow block type, self-aligning, grease-lubricated ball bearings, with ABMA 9 L-10 life at 50,000 hours.
 3. Shafts: Hot rolled steel, ground and polished, with key way, protectively coated with lubricating oil, and shaft guard.
 4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp (11.2 kW) and under, selected so required rpm is obtained with sheaves set at mid-position. Fixed sheave for 20 hp (15kW) and over, matched belts, and drive related as recommended by manufacturer or minimum 1.5 times nameplate rating of motor.
 5. Belt Guard: Fabricate to SMACNA Standard; 0.106 inch (2.6 mm) thick, ¾ inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.2 ROOF EXHAUSTERS

- A. Manufacturers:
 - 1. Penn Barry
 - 2. Twin City
 - 3. Greenheck
- B. Product Requirements:
 - 1. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.
 - 2. Sound Ratings: AMCA 301, tested to AMCA 300.
 - 3. Fabrication: Conform to AMCA 99.
 - 4. UL Compliance: UL listed and labeled, designed, manufactured and tested in accordance with UL 705.
- C. Construction
 - 1. Fan Unit: V-belt with spun aluminum up blast spun aluminum with grease tray housing; resilient mounted motor; ½ inch (13 mm) mesh, 0.62 inch (1.6 mm) thick aluminum wire bird screen; square base to suit roof curb with continuous curb gaskets.
 - 2. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.
- D. Accessories
 - 1. Roof Curb: galvanized steel aluminum with continuously welded seams, one inch (25 mm) insulation and curb bottom, interior baffle with acoustic insulation, curb bottom and factory installed nailer strip.
 - 2. Disconnect Switch: Factor-wired, non-fusible, in housing for thermal overload protected motor.
 - 3. Back-draft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked.

2.3 CABINET AND CEILING EXHAUST FANS

- A. Manufacturers:
 - 1. Greenheck
 - 2. Twin City
 - 3. Barry Blower
- B. Construction.
 - 1. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with ½ inch (13 mm) acoustic insulation, resilient mounted motor, gravity back-draft damper in discharge.
 - 2. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
 - 3. Grille: Baked white enamel finish.
 - 4. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearing.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes constant volume terminal units, variable volume terminal units, fan powered terminal units, variable volume regulators, integral sound attenuation, integral heating coils, integral damper motor operators, integral controls.
- B. Related Sections:
 - 1. Section 230923 – Direct Digital Control System.

1.2 REFERENCES

- A. NFPA 90A (National Fire Protection Association) - Installation of Air Conditioning and Ventilation Systems.
- B. UL 181 (Underwriters Laboratories, Inc.) - Factory-Made Air Ducts and Connectors.

1.3 SUBMITTALS

- A. Provide in accordance with the General Conditions of the Contract.
- B. Product Data: Submit data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings indicating airflow, static pressure, and NC designation. Include electrical characteristics and connection requirements. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 inch to 4 inches wg (250 to 1000 Pa).
- C. Manufacturer's Installation Instructions: Submit support and hanging details, and service clearances required.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.6 COORDINATION

- A. Coordinate Work with 15910 – Direct Digital Control System.

PART 2 PRODUCTS

2.1 AIR TERMINAL UNITS

- A. Manufacturers: Price, Titus, & Tuttle & Bailey.
- B. Ceiling mounted variable air volume fan powered supply air control terminals for connection to single duct, central air systems, with electronic variable volume controls, hot water heating coils.
- C. Identify each terminal unit with identification label and airflow indicator. Include unit nominal airflow, maximum factory-set airflow and minimum factory-set airflow and coil type.

2.2 SINGLE DUCT VARIABLE VOLUME AND VAV REHEAT UNITS

- A. Basic Assembly:
 - 1. Casings: Minimum 22 gage galvanized steel.
 - 2. Lining: Minimum 1 inch thick neoprene or vinyl coated glass fiber insulation, 1.5 lb./cu ft (24 g/L) density, meeting NFPA 90A requirements and UL 181 erosion requirements.
 - 3. Plenum Air Inlets: Round stub connections for duct attachment.
 - 4. Plenum Air Outlets: S slip-and-drive connections.
- B. Basic Unit:
 - 1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
 - 2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inch inlet static pressure.
 - 3. Mount damper operator to position damper normally open.
- C. Hot Water Heating Coil:
 - 1. Construction: 1/2 inch (13 mm) copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig (10380 kPa) pressure, factory installed.
 - 2. Capacity: As indicated on Drawings.
 - 3. All coils are to be 2 row.
- D. Automatic Damper Operator:
 - 1. Refer to Section 230923 – Direct Digital Control System.
- E. Thermostat: Refer to Section 230923.

2.3 FAN POWERED VARIABLE VOLUME UNITS

- A. Basic Assembly:
 - 1. Casings: Minimum 22 gage galvanized steel.
 - 2. Lining: Minimum 1 inch thick neoprene or vinyl coated glass fiber insulation, 1.5 lb./cu ft (24 g/L) density, meeting NFPA 90A requirements and UL 181 erosion requirements.
 - 3. Plenum Air Outlets: S-slip and drive connections.
- B. Basic Unit:
 - 1. Configuration: Air volume damper assembly and fan in parallel arrangement inside unit casing. Locate control components inside protective metal shroud.
 - 2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inch rated inlet static pressure.
 - 3. Mount damper operator to position damper normally open.

- C. Automatic Damper Operator:
- D. Fan Assembly
 - 1. Fan: Forward curved centrifugal type with direct drive permanent-split-capacitor type, thermally protected motor.
 - 2. Speed Control: Infinitely adjustable with and electronic controls.
 - 3. Isolation: Fan/motor assembly on rubber isolators.
- E. Hot Water Heating Coil:
 - 1. Construction: 1/2 inch (13 mm) copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig (10 380 kPa) pressure, factory installed.
 - 2. Capacity: As scheduled on Drawings.
 - 3. All coils are to be 2 row.
- F. Wiring
 - 1. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.
 - 2. Factory mount transformer for control voltage on electric and electronic control units. Furnish terminal strip in control box for field wiring of thermostat and power source.
 - 3. Wiring Terminations: Wire fan and controls to terminal strip. Furnish terminal lugs to match branch-circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.
 - 4. Disconnect Switch: Factory mount disconnect switch.
- G. Controls:
 - 1. Refer to Section 230923.
- H. Thermostat:
 - 1. Refer to Section 2309023.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify ductwork is ready to receive Work.

3.2 INSTALLATION

- A. Connect to ductwork in accordance with Section 233100.
- B. Install ceiling access doors or locate units above easily removable ceiling components.
- C. Support units individually from structure. Do not support from adjacent ductwork.
- D. Install lined ductwork downstream of units.

3.3 ADJUSTING

- A. Section 230593 - Execution Requirements: Testing, adjusting, and balancing.
- B. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 0 percent full flow. Set units with heating coils for minimum 50 percent full flow.

END OF SECTION

**SECTION 23 37 00
AIR OUTLETS AND INLETS**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes diffusers, registers/grilles, and louvers.

1.2 REFERENCES

- A. ADC 1062 (Air Diffusion Council) - Certification, Rating and Test Manual.
- B. AMCA 500 (Air Movement and Control Association) - Test Method for Louvers, Dampers and Shutters.
- C. ASHRAE 70 (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Method of Testing for Rating the Airflow Performance of Outlets and Inlets.
- D. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standard - Metal and Flexible.

1.3 SUBMITTALS

- A. Provide as per the General Conditions.
- B. Product Data: Submit data outlets and inlets sizes, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.1 CEILING DIFFUSERS

- A. Manufacturers: Price, Tempo, Tuttle & Bailey.
- B. Type: As scheduled on the Drawings
- C. Fabrication: Aluminum extrusions with factory baked enamel finish, color to be selected.
- D. Frame: 1-1/4 inch margin with countersunk screw support clips for suspension system support clips for T bar mounting and gasket Coordinate with ceiling type as shown on Architectural Drawings.
- E. Plenum: Integral, galvanized steel, insulated.

2.2 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES (PERFORATED FACE)

- A. Manufacturers: Titus, Price, Tempo, Tuttle & Bailey.
- B. Type: Perforated and removable face as scheduled on the Drawings.

- C. Coordinate mounting frame with ceiling type indicated on the Drawings.
- D. Fabrication: Steel with steel or aluminum frame.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify inlet/outlet locations.
- B. Verify ceiling and wall systems are ready for installation.

3.2 INSTALLATION

- A. Install diffusers to ductwork with airtight connection.
- B. Install balancing dampers on duct take-off to diffusers, grilles, and registers, whether or not dampers are furnished as part of diffuser, grille, and register assembly.
- C. Paint visible portion of ductwork behind air outlets and inlets matte black.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Check location of outlets and inlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.

3.4 SCHEDULES

END OF SECTION

**SECTION 23 40 00
AIR CLEANING DEVICES**

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes disposable panel filters, filter frames, filter gages.

1.2 REFERENCES

- A. ARI 850 (Air-Conditioning and Refrigeration Institute) - Commercial and Industrial Air Filter Equipment.
- B. ASHRAE 52 (American Society of Heating, Refrigerating and Air Conditioning Engineers) - Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.
- C. MIL-STD-282 - Filter Units, Protective Clothing, Gas-Mask Components, and related Products: Performance-Test Methods.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to ARI 850 Section 7.4.

1.4 SUBMITTALS

- A. Per Section 23 00 15.
- B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.
- C. Product Data: Submit data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.
- D. Manufacturer's Installation Instructions: Submit assembly and change-out procedures.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit instructions for operation, changing, and periodic cleaning.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing Work of this section with minimum three years' experience.

1.7 WARRANTY

- A. Furnish one year manufacturer warranty for air cleaning devices.

1.8 EXTRA MATERIALS

- A. Furnish one set of disposable panel filters.

PART 2 PRODUCTS

2.1 DISPOSABLE PANEL FILTERS

- A. Manufacturers: Farr, American Air Filter, ECO Air.
- B. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
 - 1. Nominal Size: 24 x 24 inches (610 x 610 mm).
 - 2. Thickness: 2 inch (50 mm).
- C. Performance Rating:
 - 1. Face Velocity: 500 fpm (2.54 m/sec)
 - 2. Initial Resistance: 0.10 inch wg (25 Pa)
 - 3. Recommended Final Resistance: 0.50 inches wg (125 Pa).
- D. Casing: Cardboard-frame with perforated metal retainer.

2.2 FILTER FRAMES AND HOUSINGS

- A. General: Fabricate filter frames and supporting structures of 16 gage (1.50 mm) galvanized steel or extruded aluminum T-section construction with necessary gaskets between frames and walls.
- B. Standard Sizes: For interchange ability of filter media of other manufacturers; for panel filters, size for 24 x 24 inches (610 x 610 mm) filter media, minimum 2 inches (50 mm) thick; for extended surface and high efficiency particulate air filters, provide for upstream mounting of panel filters.

2.3 FILTER GAGES

- A. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch wg (0-750 Pa), 3 percent of full scale accuracy.
- B. Accessories: Static pressure tips with integral compression fittings, 1/4 inch tubing, 2-way or 3-way vent valves.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

- B. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and level.
- C. Install roll media mesh in front of filters during construction and after construction until owner has permanent C of O. Replace media mesh as necessary.
- D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.
- E. Install filter gages on filter banks with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 23 51 00
BREECHING, CHIMNEYS, AND STACKS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fabricated breeching, manufactured chimneys for gas fired equipment, vent dampers, manufactured double wall chimneys for fuel fired equipment, induced draft fans, single wall metal free-standing stacks.
- B. Related Sections:
 - 1. Section 22 05 29 – Hangers and Supports: Product requirements for hangers and supports for placement by this section.
 - 2. Section 22 07 00 – Mechanical Insulation: Execution requirements for insulation specified by this section.

1.2 REFERENCES

- A. ANSI Z21.66 - Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- B. ANSI Z21.67 - Mechanically Actuated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- C. ANSI Z21.68 - Thermally Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.
- D. ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- E. ASTM A924 – General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- F. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent) Hot-Rolled Commercial Quality.
- H. NFPA 54 (ANSI Z223.1) (National Fire Protection Association) - The National Fuel Gas Code.
- I. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) - HVAC Duct Construction Standards - Metal and Flexible.
- J. UL 103 (Underwriters Laboratories, Inc.) - Standard for Factory Built Low Heat Chimneys.
- K. UL 378 (Underwriters Laboratories, Inc.) - Standard for Draft Equipment.
- L. UL 441 (Underwriters Laboratories, Inc.) - Standard for Gas Vents.
- M. UL 641 (Underwriters Laboratories, Inc.) - Standard for Low Temperature Venting Systems.

- N. UL 959 (ANSI Z181.1) (Underwriters Laboratories, Inc.) - Medium Heat Appliance Factory Built Chimneys.
- O. SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) – Guide for Steel Stack Construction.

1.3 DEFINITIONS

- A. Vent: Portion of a venting system designed to convey flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.
- B. Vent Connector: Part of a venting system that conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

1.4 DESIGN REQUIREMENTS

- A. Factory built vents and chimneys used for venting natural draft appliances complying with NFPA 211 and UL listed and labeled.
- B. All boiler flue terminations (caps) are to be installed rated for a minimum of 100 mph winds and secured with appropriate guide wires by M.C.
- C. All boiler stacks located above the penthouse roof is to be painted with a high temperature paint. Final paint color determined by owner / architect.

1.5 SUBMITTALS

- A. Submittals: provide in accordance with the General Conditions of the Contract.
- B. Product Data: Submit data indicating factory built chimneys, including dimensional details of components and flue caps, dimensions and weights, electrical characteristics and connection requirements
- C. Manufacturer's Installation Instructions: Submit assembly, support details, and connection requirements.

1.6 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 TYPE B DOUBLE WALL GAS VENTS

- A. Manufacturers: Salkirk Metalbestos, Simpson Dura-Vent, Ameri-Vent, United McGrill, and Metal Fab.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with NFPA 54, ANSI Z223.1, NFPA 31.

- B. Install breeching with minimum of joints. Align accurately at connections, with internal surfaces smooth.
- C. Support breeching from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Support vertical breeching, chimneys, and stacks at 12 foot (4 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for equivalent duct support configuration and size.
- D. For Type B double wall gas vents, maintain UL listed minimum clearances from combustibles. Assemble pipe and accessories for complete installation.
- E. Install vent dampers, locating close to draft hood collar, and secured to breeching.

END OF SECTION

Guide Specifications

Section xxxxx - Packaged Rooftop Units / Outdoor Air Handling Units

Part 1 - General

1.01 Related Documents

1.02 General Description

- A. This section includes the design, controls and installation requirements for packaged rooftop units / heat pumps / outdoor air handling units.

1.03 Quality Assurance

- A. Packaged air-cooled condenser and cold climate air-source heat pump units shall be certified in accordance with ANSI/AHRI Standard 340/360 performance rating of commercial and industrial unitary air-conditioning and heat pump equipment.
- B. Cold Climate air-source heat pump heating performance shall be laboratory tested and verified down to zero degrees ambient.
- C. Unit shall be certified in accordance with UL Standard 1995/CSA C22.2 No. 236, Safety Standard for Heating and Cooling Equipment.
- D. Unit and refrigeration system shall comply with ASHRAE 15, Safety Standard for Mechanical Refrigeration.
- E. Unit shall be certified in accordance with ANSI Z21.47b/CSA 2.3b and ANSI Z83.8/CSA 2.6, Safety Standard Gas-Fired Furnaces.
- F. Unit Energy Efficiency Ratio (EER) shall be equal to or greater than prescribed by ASHRAE 90.1, Energy Efficient Design of New Buildings except Low-Rise Residential Buildings.
- G. (Unit shall comply with Chicago code requirements for an HVAC unit (with cooling and gas heat) (with cooling and electric heat) (with cooling) (with gas heat) (with electric heat) (without cooling or heating).)
- H. Unit shall be safety certified by ETL and be ETL US and ETL Canada listed. Unit nameplate shall include the ETL/ETL Canada label.

Options:

- I. Unit cabinet construction shall be designed and manufactured to meet IBC 2009/2012 seismic standards.
- J. Unit shall be IBC 2009/2012 seismically certified. Unit shall be certified through seismic analysis and shake testing in accordance with ASCE-7-05/7-10 and ICC-ES AC-156.

- K. Unit shall be preapproved for California Office of Statewide Health Planning and Development (OSHPD) special seismic certification (OSP-0180-10).

1.04 Submittals

- A. Product Data: Literature shall be provided that indicates dimensions, operating and shipping weights, capacities, ratings, fan performance, filter information, factory supplied accessories, electrical characteristics and connection requirements. Installation, Operation and Maintenance manual with startup requirements shall be provided.
- B. Shop Drawings: Unit drawings shall be provided that indicate assembly, unit dimensions, construction details, clearances, and connection details. Computer generated fan curves for each fan shall be submitted with specific design operation point noted. Wiring diagram shall be provided with details for both power and control systems and differentiate between factory installed and field installed wiring.

1.05 Delivery, Storage, and Handling

- A. Unit shall be shipped with doors bolted shut and outside air hood closed to prevent damage during transport and thereafter while in storage awaiting installation. Horizontal configuration units shall include panels coving air intake and discharge openings.
- B. Follow Installation, Operation and Maintenance manual instructions for rigging, moving, and unloading the unit at its final location.
- C. Unit shall be stored in a clean, dry place protected from construction traffic in accordance with the Installation, Operation and Maintenance manual.

1.06 Warranty

- A. Manufacturer shall provide a limited “parts only” warranty for a period of 12 months from the date of equipment startup or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

Options:

- B. Manufacturer shall provide a “parts only” limited warranty for a period of 24 months from the date of original equipment shipment from the factory. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

- C. Manufacturer shall provide a “parts only” limited warranty for a period of 60 months from the date of original equipment shipment from the factory. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.
- D. Manufacturer shall provide a “parts only” limited warranty for a period of 120 months from the date of original equipment shipment from the factory. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided manufacturer’s written instructions for installation, operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts and air filters.

Part 2 - Products

2.01 Manufacturer

- A. Products shall be provided by the following manufacturers:
 - 1. AAON, Captive Aire, Annex
 - 2. Substitute equipment may be considered for approval that includes at a minimum:
 - a. R-410A refrigerant
 - b. Direct drive supply fans
 - c. Double wall cabinet construction
 - d. Insulation with a minimum R-value of 13
 - e. Stainless steel drain pans
 - f. Hinged access doors with lockable handles
 - g. Variable capacity compressor with 10-100% capacity
 - h. Two-stage compressors with capacities of 100% and 67%
 - i. VFD controlled variable speed compressor
 - j. Cold Climate air-source heat pump heating down to zero degrees ambient
 - k. All other provisions of the specifications must be satisfactorily addressed

2.02 Rooftop Units

A. General Description

1. Packaged rooftop unit shall include compressors, evaporator coils, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, water-cooled condensers, reheat coil, gas heaters, electric heaters, hot water coil, steam coil, exhaust fans, return fans, energy recovery wheels (if applicable), and unit controls.
2. Packaged cold climate air-source heat pump rooftop unit shall include variable speed compressors, evaporator coils, electronic expansion valves, reversing valves, filters, supply fans, dampers, air-cooled condenser coils, condenser fans, reheat coil, auxiliary dual fuel gas heaters, electric heaters, hot water coil, steam coil, exhaust fans, return fans, energy recovery wheels (if applicable), and unit controls.
3. Outdoor air handling unit shall include filters, supply fans, dampers, chilled water coils, DX evaporator coils, gas heaters, electric heaters, hot water coil, steam coil, exhaust fans, return fans, energy recovery wheels (if applicable), and unit controls.
4. Unit shall be factory assembled and tested including leak testing of the coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the controls compartment's literature pocket.
5. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
6. Unit components shall be labeled, including pipe stub outs, refrigeration system components and electrical and controls components.
7. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
8. Installation, Operation and Maintenance manual shall be supplied within the unit.
9. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's access door.
10. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's access door.

Options:

- a. Unit shall be crated for overseas shipment. Crate shall be fabricated from blocked, braced, and banded dimensional lumber and plywood.

B. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Refrigerant piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, cooling coils, reheat coil, heaters, energy recovery wheels, compressors, water-cooled condensers, and electrical and controls components shall be through hinged access doors with quarter turn, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with base (horizontal) discharge and (horizontal) return air openings. Openings shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit shall include lifting lugs on the top of the unit. (6-50, 60, 70 tons)
11. Unit shall include lifting lugs on the base of the unit. (55, 65, 75-140 tons)

Options:

- a. Interior ceiling, floor, service doors, fan inlet cone, damper rack, and filter rack in the air stream are spray coated with a two-part polyurethane, heat baked coating. The coils, coil casings, condensate drain pans, damper blades and gears, fan wheel, fan motor, energy recovery wheel casing, and compressor cabinet are not coated. Option is intended for use in coastal saltwater conditions under the stress of heat, salt, sand and wind and is applicable to all corrosive environments where a polyurethane coating is acceptable. Coating withstands at least 2,500 hours when tested under ASTM B 117-95 requirements.
- b. Unit base pan shall be provided with 1/2 inch thick foam insulation.
- c. Unit shall include factory installed burglar bars on the supply and return air openings.
- d. Unit shall include factory wired control panel compartment LED service lights.
- e. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.
- f. Unit shall include factory installed welded wire mesh screen on the face of the condenser coil.
- g. Unit shall include factory provided and installed UV lights.

C. Electrical

- 1. Unit shall be provided with standard power block for connecting power to the unit.
- 2. Unit shall have a 5 (10) kAIC SCCR.

Options:

- a. Unit shall have a 35 kAIC SCCR with a factory wired circuit breaker.
- b. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
- c. Unit shall be provided with factory installed and factory wired circuit breaker.
- d. Air-source heat pump shall include a defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation. Defrost cycle shall begin when outdoor coil temperature is below a fixed setpoint and have a fixed 10 minute run time, or end when the outdoor coil temperature is above a fixed setpoint. Defrost timer, with 30/60/90 minute selectable defrost cycle interval time, shall be factory installed in the controls compartment. During defrost cycle all compressors shall energize,

reversing valve shall energize, and auxiliary heat shall energize. [Controls by Others]

- e. Air-source heat pump shall include an optimized start defrost cycle to prevent frost accumulation on the outdoor coil during heat pump heating operation and to minimized defrost cycle energy usage. If the temperature of the outdoor heat exchanger and/or the suction line is less than a predetermined value, a deferred defrost cycle is initiated wherein the defrost cycle starts after a variable, continuously optimizing, time interval has elapsed. The defrost cycle is terminated when the relative temperatures of the outdoor heat exchanger and/or the suction line indicate that sufficient frost is melted from the heat exchanger to insure adequate time between successive defrost cycles for optimizing the efficiency and reliability of the system, or after a predetermined time interval has elapsed, whichever condition occurs first. During defrost cycle all compressors shall energize, reversing valves shall energize, and auxiliary heat shall energize. [Orion Controls System]
- f. Unit shall be provided with factory installed and factory wired 115V, 12 amp GFI outlet with outlet disconnect switch in the unit control panel.
- g. Unit shall be provided with factory installed and field wired 115V, 20 amp GFI outlet in the unit control panel.
- h. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more that 10% out of balance on voltage, the voltage is more that 10% under design voltage, or on phase reversal.
- i. Unit shall be provided with manual reset low temperature limit controls that shut off the unit when the discharge temperature reaches a field adjustable setpoint. Supply air temperature sensor shall be factory provided for field installation in the supply air ductwork.
- j. Unit shall be provided with blower auxiliary contacts on the low voltage terminal block which close when the supply fans are energized.
- k. Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

D. Supply Fans

- 1. Unit shall include direct drive, unhooded, backward curved, plenum supply fans.
- 2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
- 3. Motors shall be standard (premium) efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

Options:

- a. Variable frequency drives shall be factory wired and mounted in the unit.
Fan motors shall be premium efficiency.
- b. Motor shall include shaft grounding.

E. Exhaust Fans

- 1. Exhaust dampers shall be sized for 100% relief.
- 2. Fans and motors shall be dynamically balanced.
- 3. Motors shall be standard (premium) efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
- 4. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn handles.

Options:

- a. Unit shall include belt driven, unhooded, backward curved, plenum exhaust fans.
- b. Unit shall include belt driven forward curved exhaust fans.
- c. Unit shall include direct drive, axial flow exhaust fans. Blades shall be adjustable pitch.
- d. Variable frequency drives shall be factory wired and mounted in the unit.
Fan motors shall be premium efficiency.
- e. Motor shall include shaft grounding.

F. Return Fans

- 1. Unit shall include direct drive, axial flow return fans. Blades shall be adjustable pitch.
- 2. Unit shall include (barometric) (motorized) relief dampers.
- 3. Fans and motors shall be dynamically balanced.
- 4. Motors shall be standard (premium) efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
- 5. Access to return fans shall be through double wall, hinged access doors with quarter turn handles.

Options:

- a. Variable frequency drives shall be factory wired and mounted in the unit.
Fan motors shall be premium efficiency.

- b. Motor shall include shaft grounding.

G. Cooling Coils

1. Evaporator Coils

- a. Coils shall be designed for use with R-410A refrigerant and constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and galvanized (304 stainless) steel end casings. Fin design shall be sine wave rippled.
- b. Coils shall have interlaced circuitry and shall be standard (6 row high) capacity [9 and 11-140 ton units].
- c. Coils shall be standard (6 row high) capacity [6-8, 10 units].
- d. Coils shall be helium or hydrogen leak tested.
- e. Coils shall be furnished with a factory installed expansion valves.

Options:

- 1. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.
- 2. Units shall include a cooling coil with a return air bypass damper for improved dehumidification. Return air bypass shall interject, into the supply air, a portion of return air downstream of the cooling coil. This bypass of return air, as reheat, shall allow the cooling coil to absorb more latent heat from the incoming outside air and the remaining portion of the return air over a broad range of operating conditions, but especially at low load conditions.
- 3. Units shall include a cooling coil with a mixed air bypass damper for improved dehumidification. Mixed air bypass shall interject, into the supply air, a portion of mixed air downstream of the cooling coil. This bypass of mixed air, as reheat, shall allow the cooling coil to absorb more latent heat from the remaining portion of the mixed air over a broad range of operating conditions, but especially at low load conditions.

2. Chilled Water Cooling Coils

- a. Coils shall be certified in accordance with AHRI Standard 410 and be helium or hydrogen leak tested.
- b. Coil shall be constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and galvanized (304 stainless) steel end casings. Fin design shall be sine wave rippled.
- c. Coil shall have single (half) serpentine circuitry, 4 (6) rows, and 8 (10) (12) fins per inch.
- d. Control valves shall be field supplied and field installed.

Options:

1. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.

H. Refrigeration System

1. Unit shall be factory charged with R-410A refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam insulated panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.

6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides, and factory installed liquid line filter driers.
7. Unit shall include 1 (2) (4) (5) (6) stages of capacity control.
8. Suction line filters with isolation valves shall be factory installed. (55, 65, 75-140 tons)

Options:

- a. Unit shall include a two-stage compressor that shall modulate between two capacity settings, 67% and 100%. [7, 8 & 10 tons]
- b. Unit shall include dual two-stage compressors that shall each modulate between two capacity settings, 67% and 100%. [9 & 11-20 & 26 tons]
- c. Unit shall include a variable capacity scroll compressor on the refrigeration circuit which shall be capable of modulation from 10-100% of its capacity. [6-8 & 10 tons]
- d. Unit shall include a variable capacity scroll compressor on the lead (all) refrigeration circuit(s) which shall be capable of modulation from 10-100% of its capacity. [9 & 11-25 & 30 tons]
- e. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity and a two-stage compressor on the lag circuit that shall modulate between two capacity settings, 67% and 100%. [9 & 26 tons]
- f. Unit shall include a variable capacity scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity and a tandem staged compressor on the lag circuit. [31 tons]
- g. Unit shall include a variable capacity tandem scroll compressor on the lead refrigeration circuit which shall be capable of modulation from 10-100% of its capacity and a tandem staged compressor on the lag circuit. [40 tons]
- h. Unit shall include a VFD controlled, variable speed scroll compressor on the refrigeration circuit, which shall be capable of modulating refrigerant capacity. [7, 8 & 10 tons]
- i. Unit shall include a VFD controlled, variable speed scroll compressor on the lead refrigeration circuit, which shall be capable of modulating refrigerant capacity, and an on/off compressor on the lag circuit. [9 & 30 tons]

- j. Unit shall include a VFD controlled, variable speed scroll compressor on the lead refrigeration circuit, which shall be capable of modulating refrigerant capacity, and a two-stage compressor on the lag circuit that shall modulate between two capacity settings, 67% and 100%. [11, 13, 20, 25, 26 tons]
- k. Unit shall include a VFD controlled, variable speed scroll compressor on the refrigeration circuit, which shall be capable of modulating refrigerant capacity. [16 tons]
- l. Unit shall include a VFD controlled, variable speed scroll compressor on the lead refrigeration circuit, which shall be capable of modulating refrigerant capacity, and a tandem staged compressor on the lag circuit. [31 tons]
- m. Unit shall include a VFD controlled, variable speed tandem scroll compressor on the lead refrigeration circuit, which shall be capable of modulating refrigerant capacity, and a tandem staged compressor on the lag circuit. [40, 50, 60 & 70 tons]
- n. Unit shall include two VFD controlled, variable speed scroll compressors on the two lead refrigeration circuits, which shall be capable of modulating refrigerant capacity over the full face area of the evaporator coil. Unit shall include a tandem staged compressor on the single lag circuit. [55, 65, 75-140 tons]
- o. Unit shall include factory provided and installed compressor sound jackets on all compressors.
- p. Lead (Lag) (All) refrigeration circuit(s) shall be provided with aluminum microchannel hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a dehumidification control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space. Reheat coil shall be piping in a (series) (parallel) configuration.
- q. Unit shall be configured as a cold climate air-source heat pump. Refrigeration circuit shall each be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and electronic expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump cooling mode of operation.
- r. Unit shall be configured as an air-source heat pump. Each refrigeration circuit shall each be equipped with a factory installed liquid line filter drier with check valve, reversing valve, accumulator, and expansion valves on both the indoor and outdoor coils. Reversing valve shall energize during the heat pump cooling mode of operation.
- s. Unit shall be configured as a water-source heat pump. Each refrigeration circuit shall each be equipped with a factory installed liquid line filter drier

with check valve, reversing valve, and expansion valves on both the indoor coil and refrigerant-to-water heat exchanger. Reversing valve shall energize during the heat pump cooling mode of operation.

- t. Each refrigeration circuit shall be equipped with a liquid line sight glass.
- u. Each refrigeration circuit shall be equipped with suction and discharge compressor isolation valves.
- v. Each capacity stage shall be equipped with a 5 minute off, delay timer to prevent compressor short cycling.
- w. Each capacity stage shall be equipped with an adjustable, 20 second delay timer to prevent multiple capacity stages from starting all at once.
- x. Lead (All) (Lag) refrigeration circuit(s) shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.
- y. Unit shall be provided with an adjustable compressor lockout.
- z. First capacity stage shall be provided with adjustable on/off condenser fan cycling and an adjustable compressor lockout to allow cooling operation down to 35°F.
- aa. Lead refrigeration circuit shall be equipped with flooded condenser low ambient head pressure control to allow operation down to 0°F. Option includes an adjustable compressor lockout.
- bb. Each refrigeration circuit shall be provided with an adjustable temperature sensor freeze stat which shuts down the cooling circuits when the evaporator coil tubing falls below the setpoint.
- cc. Reheat Coil shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.

I. Condensers

1. Air-Cooled Condenser

- a. Condenser fans shall be vertical discharge, axial flow, direct drive fans.
- b. Coils shall be designed for use with R-410A refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
- c. Heat pump outdoor coil shall be constructed of copper tubes with aluminum (copper) fins mechanically bonded to the tubes and aluminum end casings. Fin design shall be sine wave rippled.
- d. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.

Options:

1. Condenser fans shall be high efficiency electronically commutated motor driven with multiple speeds which are controlled with a fan cycle switch based on head pressure and allow matching condenser airflow with cooling capacity steps.
2. Condenser fans shall be high efficiency electronically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.
3. Condenser fans shall be low sound, high efficiency electronically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F. Condenser fan housing shall be fabricated of composite material and include an optimized orifice with inlet guide vanes. The condenser fan blade shall be serrated and aerodynamically designed for high efficiency and reduced sound levels.
4. Condenser fans shall be VFD driven variable speed for condenser head pressure control. Factory provided and factory programmed VFDs shall continuously modulate the fan air flow to maintain head pressure at acceptable levels. Cooling operation shall be allowed down to 35°F with adjustable compressor lockout.
5. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be

followed. Refer to the unit Installation, Operation and Maintenance Manual.

2. Water-Cooled Condenser

- a. Water-cooled condensing section shall contain plate type, heat exchangers located in an insulated vestibule. Heat exchangers shall be circuited in a counter flow arrangement to the refrigerant system. Plates shall be stainless steel. Each heat exchanger shall be provided with a removable and cleanable type, basket filter on the waterside circuit. Field piping connections shall be made at each plate heat exchanger within the condensing section of the rooftop unit. Maximum operating pressure on the water side of the condenser shall be 125 psi.
- b. All field installed piping shall be hydrostatically tested before being put into service. Test pressure shall be 125 psi for a two hour duration. Leaks and loss in test pressure constitute defects. If test fails, corrections shall be made to the system and the test shall then be repeated to make certain all defects were corrected. All testing shall be performed to ASTM Standards.

Options:

1. Each heat exchanger circuit shall have a factory installed ball valve for water balancing.
2. Each heat exchanger circuit shall have a flow switch that shuts down the compressors if water flow to the condenser is interrupted.
3. Each heat exchanger circuit shall have a factory installed motorized shutoff valve.
4. Unit shall include factory installed head pressure control module and each heat exchanger shall include factory installed head pressure control valve which modulates the condenser water flow based on head pressure and allows cooling operation below 65°F condenser water temperature.

J. Gas Heating

1. Unit shall include a natural gas furnace with 2 (4) stages of capacity.
2. Aluminized steel (Stainless steel) heat exchanger furnace shall carry a 15 (25) year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Gas furnace shall consist of aluminized (stainless) steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.

4. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
5. Unit shall include a single (two) gas connection and have gas supply piping entrances in the unit base for through-the-curb gas piping and in the outside cabinet wall for across the roof gas piping.

Options:

- a. Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet.
- b. High Turndown Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls compartment. Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet. Heat trace shall be include on the condensate drain line.
- c. Unit shall include an LP gas furnace(s) with two stages of capacity.
- d. Auxiliary gas heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Dual fuel auxiliary heating capacity shall be available for operation when heat pump heating is in operation. Unit shall include 2 (4) stages of auxiliary gas heating capacity. [Heat Pump - Auxiliary Heat Sizing]
- e. Emergency gas heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is not in operation. Auxiliary gas heating capacity shall be equal in capacity to the emergency gas heating capacity. Dual fuel auxiliary heating capacity shall be available for operation when heat pump heating is in operation. Unit shall include 2 (4) stages of auxiliary gas heating capacity. [Heat Pump - Emergency Heat Sizing]

K. Electric Heating

1. Unit shall include an include electric heater consisting of electric heating coils, fuses, and a high temperature limit switch, with capacities as shown on the plans.
2. Unit shall include 1 (2) (4) (6) (7) (8) stages of capacity.
3. Electric heating coils shall be located in the reheat position downstream of the supply fans.

Options:

- a. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). Supply air temperature sensor shall be factory provided and field installed in the supply air ductwork. A setpoint adjustment potentiometer shall be factory provided.
- b. Electric heater shall have full modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A 0-10 VDC heating control signal shall be field provided to control the amount of heating.
- c. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Auxiliary heating capacity shall be available for operation when heat pump heating is in operation. Unit shall include 1 (2) (4) stages of auxiliary electric heating capacity. [Heat Pump - Auxiliary Heat Sizing]
- d. Emergency electric heating capacity shall be sized by determining the maximum electric heating capacity not to exceed the amp draw of all compressors and adding that electric heating capacity to the auxiliary electric heating capacity. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Unit shall include 1 (2) (4) stages of auxiliary electric heating capacity. [Heat Pump - MCA Limited Heat Sizing]
- e. Emergency electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is not in operation. Auxiliary electric heating capacity shall be sized to meet heating leaving air temperature setpoint when heat pump heating is in operation. Unit shall include 1 (2) (4) stages of auxiliary electric heating capacity. [Heat Pump - Emergency Heat Sizing]

L. Preheat

1. Hot Water Preheat Coil
 - a. Coils shall be certified in accordance with AHRI Standard 410 and be helium or hydrogen leak tested.

- b. Coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
 - c. Coil shall be one (two) row and 8 (10) (12) fins per inch.
 - d. Unit shall include a mixed air (outside air) preheat coil.
 - e. Control valves shall be field supplied and field installed.
2. Steam Distributing Preheat Coil
- a. Coils shall be helium or hydrogen leak tested.
 - b. Tube-in-tube distributing coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
 - c. Coil shall be one (two) row and 8 (10) (12) fins per inch.
 - d. Unit shall include a mixed air (outside air) preheat coil.
 - e. Control valves shall be field supplied and field installed.
3. Electric Preheat
- a. Unit shall include an electric heater consisting of electric heating coils, fuses, and a high temperature limit switch.
 - b. Electric heating coils shall be located in the outside air preheat position.
 - c. Electric heater shall have modulation capacity controlled by an SCR (Silicon Controlled Rectifier). A preheat enable signal shall be required from the unit controller.

M. Heating Coils

1. Hot Water Heating Coils

- a. Coils shall be certified in accordance with AHRI Standard 410 and be helium or hydrogen leak tested.
- b. Coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- c. Coil shall have single (half) serpentine circuitry, 1 (2) rows, and 8 (10) (12) fins per inch.
- d. Coil shall be located in the reheat position downstream of the supply fans.
- e. Control valves shall be field supplied and field installed.

Options:

1. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.
2. Hot water heating capacity shall be available for operation when heat pump heating is in operation and when heat pump heating is not in operation.

2. Steam Distributing Heating Coils

- a. Coils shall be helium or hydrogen leak tested.
- b. Tube-in-tube distributing coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
- c. Coil shall be 1 (2) row and 8 (10) (12) fins per inch.
- d. Coil shall be located in the reheat position downstream of the supply fans.
- e. Control valves shall be field supplied and field installed.

Options:

1. Coils shall have a flexible, epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Humidity and water immersion resistance shall be up to a minimum 1,000 hours each (ASTM D2247-92 and ASTM D870-92). Corrosion durability shall be confirmed through testing, with coating capable of withstanding at least 10,000 hours of salt spray per ASTM B117-90. Coated coils shall receive a spray-applied, UV-resistant polyurethane topcoat to prevent UV degradation of the e-coat. Coating shall carry a 5 year warranty, from the date of original equipment shipment from the factory. Instructions coil cleaning, maintenance, and recording keeping must be followed. Refer to the unit Installation, Operation and Maintenance Manual.
2. Steam heating capacity shall be available for operation when heat pump heating is in operation and when heat pump heating is not in operation.

N. Filters

Options:

1. Unit shall include 2 inch thick, fiberglass throwaway filters with an ASHRAE MERV rating of 4, upstream of the cooling coil.
2. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
3. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
4. Unit shall include a 2 inch thick, permanent filter frame with replaceable media, upstream of the cooling coil.
5. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE rating of 11 (13) (14), upstream of the cooling coil. Unit shall also include 2 inch thick, pleated panel pre filters with an ASHRAE MERV rating of 8, upstream of the 4 inch standard filters.
6. Unit shall include 4 inch thick, pleated panel filters with an ASHRAE MERV rating of 13 (14) in the final filter position down stream of all air stream unit components.
7. Unit shall include 12 inch thick, pleated cartridge filters with an ASHRAE MERV rating of 13 (14), in the final filter position down stream of all air stream unit components.
8. Unit shall include 5/16 inch lint screen pre filters upstream of the standard filters.
9. Unit shall include 1 inch aluminum mesh pre filters upstream of the outside air opening.
10. Unit shall include a clogged filter switch.
11. Unit shall include a Magnehelic gauge mounted in the controls compartment.

O. Outside Air/Economizer

Options:

1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge and end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return (sensible temperature activated 3 position) (enthalpy activated 3 position) (sensible temperature activated fully

modulating) (enthalpy activated fully modulating) (sensible temperature activated fully modulating with dual minimum position) (enthalpy activated fully modulating with dual minimum position) (DDC) actuator. Unit shall include outside air opening bird screen, outside air hood and barometric relief dampers.

Options:

- a. Economizer shall be furnished with return air CO₂ override.
 - b. Economizer shall be furnished with the Constant Volume Outside Air ventilation control assembly which maintains a minimum amount of entering outside air. It shall measure the outside air velocity pressure and adjust the economizer dampers to maintain a constant velocity pressure and thus a constant volume of outside air.
 - c. Economizer shall be furnished with a California Energy Commission Certified Title 24 Fault Detection and Diagnostic package. Economizer assembly shall carry a 5 year parts warranty from the date of original equipment shipment from the factory.
2. Unit shall include 0-50% adjustable, motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return (2 position) (DDC) actuator. Unit shall include outside air opening bird screen, outside air hood and a return air connection.
 3. Unit shall include 100% motor operated outside air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring return, 2 position actuator. Unit shall include outside air opening bird screen and outside air hood.
 4. Unit shall include 0-25% manually adjustable outside air damper assembly, bird screen, outside air hood and a return air connection.
 5. Unit shall include 100% outside air opening, without a damper assembly, with bird screen, and outside air hood.
 6. Unit shall be 100% return air with no outside air opening, only a return air connection.

7. Unit shall include outside airflow measuring station and airflow signal processor that communicates directly with the factory provided control systems or can also be used with customer provided controls with a 0-10 VDC output signal. LonTalk and BACnet may also be available for some applications. Monitoring size is dependent on the cfm.

P. Energy Recovery **(if applicable, see plan schedule)**

1. Energy Recovery wheel shall not be used in a hazardous chemical environment covered in 2021 IMC section 510 (ex. nail salon, hair salon, lab/dust environment, etc.). For all others, see below:
2. Unit shall contain a factory mounted and tested energy recovery wheel(s). The energy recovery wheel(s) shall be mounted in a rigid frame containing the wheel drive motor, drive belt, wheel seals and bearings.
3. Wheel frame shall slide out for service and removal from the cabinet [6-50, 60, and 70 ton units].
4. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in the cassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with *ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangers* and *AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment*. *Cassettes shall be listed in the AHRI Certified Products.*
5. Unit shall include 2 inch thick, pleated panel outside air filters with an ASHRAE MERV rating of 8, upstream of the wheels. (Unit shall include 2 inch thick, pleated panel outside air and exhaust air filters with an ASHRAE MERV rating of 8, upstream of the wheels.)
6. Hinged service access door shall allow access to the wheel(s).

Options:

a. Polymer Energy Recovery Wheels

1. Shall be provided with removable energy transfer matrix. Wheel frame construction shall be a welded hub, spoke and rim assembly of stainless, plated and/or coated steel and shall be self-supporting without matrix segments in place. Segments shall be removable without the use of tools to facilitate maintenance and cleaning. Wheel bearings shall be selected to provide an L-10 life in excess of 400,000 hours. Rim shall be continuous rolled stainless steel and the wheel shall be connected to the shaft by means of taper locks.

2. All diameter and perimeter seals shall be provided as part of the cassette assembly and shall be factory set. Drive belts of stretch urethane shall be provided for wheel rim drive.
 3. Polymer Energy recovery wheel cassette shall carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory. The first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less, shall be covered under the standard AAON limited parts warranty. The remaining period of the warranty shall be covered by Airxchange. The 5-year warranty applies to all parts and components of the cassette, with the exception of the motor, which shall carry an 18 month warranty. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the Airxchange written instructions for installation, operation and maintenance have been followed. Refer to the Airxchange Energy Recovery Cassette Limited Warranty Certificate.
 4. Total energy recovery wheels shall be coated with silica gel desiccant permanently bonded by a process without the use of binders or adhesives, which may degrade desiccant performance. The substrate shall be lightweight polymer and shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments shall be washable with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
 5. Sensible energy recovery wheels shall be constructed of lightweight polymer and shall be provided without desiccant coating and shall not degrade nor require additional coatings for application in marine or coastal environments. Segments shall be washable with detergent or alkaline coil cleaner and water.
- b. Aluminum Energy Recovery Wheels
1. Unit shall contain a factory mounted and tested monolithic aluminum energy recovery wheel with an inverter duty motor and a durable segmented link drive belt composite. Wheel frame shall be constructed with prime G90 hot-dip galvanized steel tested for corrosion resistance of 400 hours of salt spray.
 2. Aluminum Energy recovery wheel shall be covered under the standard AAON limited parts warranty; the first 12 months from the date of equipment startup, or 18 months from the date of original equipment shipment from the factory, whichever is less. Warranty shall cover material and workmanship that prove defective, within the specified warranty period, provided the written instructions for installation,

operation and maintenance have been followed. Warranty excludes parts associated with routine maintenance, such as belts.

3. Total energy recovery wheels shall be made of corrugated aluminum with a 3A molecular sieve desiccant coating. Coated segments shall be cleanable with hot water or air without degrading the latent recovery.
 4. Sensible energy recovery wheels shall be made of corrugated aluminum and not coated. Segments shall be cleanable with hot water or air.
- c. Unit shall include energy recovery wheel defrost control which includes an adjustable temperature sensor and timer wired to periodically stop the wheel rotation, which allows the warm exhaust air to defrost the wheel.
 - d. Unit shall include energy recovery wheel rotation detection sensors and a set of normally open and normally closed contacts for field indication of wheel rotation.
 - e. Energy recovery wheel shall include field adjustable mechanical purge. Purge shall be capable of limiting Exhaust Air Transfer Ratio (EATR) values to less than 1% through proper fan and purge adjustment.

Q. Controls

1. Factory Installed and Factory Provided Controller

- a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
- b. Controller shall be capable of standalone operation with unit configuration, set point adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
- c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
- d. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.
- e. Variable Air Volume Controller
 1. Unit shall utilize a variable capacity compressor system (stage compressor system) (chilled water system) and a variable speed supply fan system to modulate cooling and airflow as required to meet space temperature cooling loads and to save operating energy. Supply fan

- speed shall modulate based on supply air duct static pressure. Cooling capacity shall modulate based on supply air temperature.
2. Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.
 3. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
 4. Unit shall modulate heating with constant airflow to meet space temperature heating loads. With staged heating, capacity shall modulate based on space temperature. With modulating heating, capacity shall modulate based on supply air temperature.
- f. Constant Volume Controller
1. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
 2. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
 3. Unit shall modulate heating with constant airflow to meet space temperature heating loads. With staged heating, capacity shall modulate based on space temperature. With modulating heating, capacity shall modulate based on supply air temperature.
- g. Makeup Air Controller
1. Unit shall modulate cooling with constant airflow to meet ventilation outside air loads. Cooling capacity shall modulate based on supply air temperature.
 2. Hot gas bypass shall be required on the lead refrigeration circuits of systems without variable capacity compressors.
 3. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet outside air humidity loads and prevent supply air temperature swings and overcooling of the space.
 4. Unit shall modulate heating with constant airflow to meet ventilation outside air loads. Heating capacity shall modulate based on supply air temperature.
- h. D-PAC Controller
1. Unit shall be equipped with variable capacity compressor, return air bypass and modulating hot gas reheat.
 2. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
 3. Unit shall modulate cooling, return air bypass damper, and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.

4. Unit shall modulate heating with constant airflow to meet space temperature heating loads. With staged heating, capacity shall modulate based on space temperature. With modulating heating, capacity shall modulate based on supply air temperature.
- i. PAC Controller
 1. Unit shall be equipped with return air bypass and modulating hot gas reheat.
 2. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
 3. Unit shall modulate cooling, return air bypass damper, and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
 4. Unit shall modulate heating with constant airflow to meet space temperature heating loads. With staged heating, capacity shall modulate based on space temperature. With modulating heating, capacity shall modulate based on supply air temperature.
 - j. Single Zone VAV
 1. Unit shall utilize a variable capacity compressor system and a variable speed fan system to modulate cooling and airflow as required in meeting the space temperature needs and to save unit operating energy. Unit fan speed shall modulate based on space temperature, not supply air pressure.
 2. Units with modulating heat (modulating gas, SCR electric, variable capacity heat pump, hydronic coils) shall be capable of modulating fan speed in both the heating and cooling mode.
 3. With modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
 4. Unit shall be provided with supply air temperature control. Mixing boxes and bypass ducts shall not be required for operation as a single zone VAV system.

Options:

1. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall

be capable of communicating and integrating with a LonWorks or BACnet network. [Orion Controls System]

2. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with a touchscreen controller interface. Controller shall be capable of communicating and integrating with a BACnet MS/TP or Modbus RTU network. [AAON Touchscreen Controller].

2. Field Installed DDC Controls by Others

- a. Controls shall be field provided and field installed by others.

3. Factory Installed DDC Controls by Others

- a. Controls shall be furnished by others and factory installed.

Options:

1. Isolation relays shall be factory installed.

4. Standard Terminal Block

- a. Unit shall be provided with a terminal block for field installation of controls.

Options:

1. Isolation relays shall be factory installed.

R. Accessories

Options:

1. Unit shall be provided with a smoke detector(s) sensing the return air (supply air) (return and supply air) of the unit, wired to shut off the unit's control circuit.
2. Unit shall be provided with a terminal block for field installation of a smoke detector which shuts off the unit's control circuit.
3. Unit shall be provided with a firestat sensing the return and supply air of the unit, wire to shut off the unit's control circuit.
4. Unit shall be provided with a high condensate level switch that shuts down the unit when a high water level is detected in the drain pan.

2.03 Curbs

- A. Curbs shall to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support and air seal for the unit. Curb gasket shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting of the rooftop unit.

- B. Knockdown curbs (with duct support rails) shall be factory furnished for field assembly.
- C. Solid bottom curb shall be factory assembled and fully lined with 1 inch fiberglass insulation and include a wood nailer strip. (Curb shall be adjustable up to 3/4 inch per foot to allow for sloped roof applications.)

Part 3 - Execution

3.01 Installation, Operation, and Maintenance

- A. Installation, Operation and Maintenance manual shall be supplied with the unit.
- B. Installing contractor shall install unit, including field installed components, in accordance with Installation, Operation and Maintenance manual instructions.
- C. Start up and maintenance requirements shall be complied with to ensure safe and correct operation of the unit.

SECTION 23 74 13: PACKAGED ROOFTOP AIR CONDITIONING UNITS

PART 1 GENERAL

1.01 REFERENCES

- A. NFPA 90 A & B - Installation of Air Conditioning and Ventilation Systems and Installation of Warm Air Heating and Air Conditioning Systems.
- B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- C. AHRI 360 - Commercial and Industrial Unitary Air Conditioning Equipment testing and rating standard.
- D. ANSI/ASHRAE 37 - Testing Unitary Air Conditioning and Heat Pump Equipment.
- E. ANSI/ASHRAE/IESNA 90.1-1999 - Energy Standard for New Buildings Except Low-Rise Residential Buildings.
- F. ANSI Z21.47/UL1995 - Unitary Air Conditioning Standard for safety requirements.
- G. AHRI 210/240 - Unitary Air-Conditioning Equipment and Air- Source Heat Pump Equipment.
- H. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.
- I. ANSI/NFPA 70-1995 - National Electric Code.

1.02 SUBMITTALS

- A. Submit unit performance data including: capacity, nominal and operating performance.

1.03 DELIVERY, STORAGE and HANDLING

- A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.04 WARRANTY

- A. Provide full parts and labor warranty (excluding refrigerant) for one year from start-up or 18 months from shipment, whichever occurs first.

1.05 REGULATORY REQUIREMENTS

- A. Unit shall conform to ANSI Z21.47/UL1995 for construction of packaged air conditioners.
 - 1. In the event the unit is not UL approved, the manufacturer must, at his expense, provide for a field inspection by a UL representative to verify conformance to UL standards. If necessary, contractor shall perform

modifications to the unit to comply with UL, as directed by the UL representative, at no additional expense to the Owner.

PART 2 PRODUCTS

2.01 SUMMARY

- A. The contractor shall furnish and install package rooftop unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

- B. APPROVED MANUFACTURERS

- 1. York/JCI – Fraser-Johnston
 - 2. Daikin
 - 3. Trane

2.02 GENERAL UNIT DESCRIPTION

- A. Unit(s) furnished and installed shall be DX cooling, gas heat packaged rooftop (s) as scheduled on contract documents and these specifications. Cooling capacity ratings shall be based on AHRI Standards. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, return-air filters, supply motors and unit controls.

- B. Unit(s) shall be 100% factory run tested and fully charged with R-410A.

2.03 UNIT CASING

- A. Cabinet: Galvanized steel, phosphatized, and finished with an air-dry paint coating with removable access panels. Structural members shall be 18 gauge with access doors and removable panels of minimum 20 gauge.
- B. Unit cabinet surface shall be tested 1000 hours in salt spray test in compliance with ASTM B117.
- C. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket-sealed.
- D. Access Panels: Water- and air-tight panels with handles shall provide access to filters, heating section, return air fan section, supply air fan section, evaporator coil section, and unit control section.
- E. Unit base pan shall have a raised 1 1/8 inch high lip around the supply and return openings for water integrity.
- F. Insulation: Provide 1/2 inch thick fiberglass insulation with foil face on all exterior panels in contact with the return and conditioned air stream. All edges must be captured so that there is no insulation exposed in the air stream.
- G. Provide openings either on side of unit or through the base for power, control,

condensate, and gas connections.

2.04 AIR FILTERS

- A. Air Filters: Factory installed filters shall mount integral within the unit and shall be accessible through access panels. One-inch thick glass fiber disposable media filters shall be provided with the provisions within the unit for 2 inch thick filters to be field-provided and installed.

2.05 FANS AND MOTORS

- A. Provide evaporator fan section with forward curved, double width, double inlet, centrifugal type fan.
- B. Provide self-aligning, grease lubricated, ball or sleeve bearings with permanent lubrication fittings.
- C. Provide units 5 tons and below with belt driven, supply fans with adjustable motor sheaves.
- D. Provide units 6 tons and above with belt driven, supply fans with adjustable motor sheaves.
- E. Outdoor and Indoor Fan motors shall be permanently lubricated and have internal thermal overload protection.
- F. Outdoor fans shall be direct drive, statically and dynamically balanced, draw through in the vertical discharge position.
- G. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.06 GAS FIRED HEATING SECTION

- A. Completely assembled and factory installed heating system shall be integral to unit, UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Threaded connection with plug or cap provided.
- B. Induced draft combustion type with direct spark ignition system, and redundant main gas valve.
- C. Gas Burner Safety Controls: Provide safety controls for the proving of combustion air prior to ignition, and continuous flame supervision. Provide flame rollout switches.
- D. Induced draft blower shall have combustion air proving switches and built-in thermal overload protection on fan motor.
- E. Heat Exchanger: Provide tubular section type constructed from 18-gauge aluminized steel.
- F. Limit controls: High temperature limit controls will shut off gas flow in the event of

excessive temperatures resulting from restricted indoor airflow or loss of indoor airflow.

2.07 EVAPORATOR COIL

- A. Provide configured aluminum fin surface mechanically bonded to copper tubing coil.
- B. Provide an independent expansion device for each refrigeration circuit. Factory pressure tested at 450 psig and leak tested at 200 psig.
- C. Provide a removable, reversible, cleanable double sloped drain pan for base of evaporator coil constructed of PVC.

2.08 CONDENSER SECTION

- A. Provide vertical discharge, direct drive fans with aluminum blades. Fans shall be statically balanced. Motors shall be permanently lubricated, with integral thermal overload protection in a weather tight casing.

2.09 REFRIGERATION SYSTEM

- A. Compressor(s): Provide scroll compressor with direct drive operating at 3600 rpm. Integral centrifugal oil pump. Provide suction gas cooled motor with winding temperature limits and compressor overloads.
- B. Units shall have cooling capabilities down to 0 degree F as standard. For field-installed low ambient accessory, the manufacturer shall provide a factory-authorized service technician that will assure proper installation and operation.
- C. Provide each unit with refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, suction and liquid line pressure ports.

2.10 EXHAUST/RETURN SECTION

- A. Provide 100% factory supplied field installed ON/OFF power centrifugal exhaust assembly – two positions.
- B. If factory installed settings/options endure a longer lead time than usual, contact engineer for possible 3rd party economizer, smoke detectors, & power exhaust systems etc. prior to ordering RTU(s) for approval.

2.11 OUTDOOR AIR SECTION

- A. Provide economizer with comparative enthalpy control.
- B. Provide adjustable minimum position control located in the economizer section of the unit.
- C. Provide spring return motor for outside air damper closure during unit shutdown or power interruption.

2.12 OPERATING CONTROLS

- A. Provide microprocessor unit-mounted DDC control which when used with an electronic zone sensor provides proportional integral room control. This UCM shall perform all unit functions by making all heating, cooling, and ventilating decisions through resident software logic.
- B. Provide factory-installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
- C. Provide an anti-cycle timing and minimum on/off between stages timing in the microprocessor.
- D. Economizer Preferred Cooling (if supplied with economizer) - Compressor operation is integrated with economizer cycle to allow mechanical cooling when economizer is not adequate to satisfy zone requirements. Compressors are enabled if space temperature is recovering to cooling setpoint at a rate of less than 0.2 degrees per minute. Compressor low ambient lockout overrides this function.

2.13 ROOF CURB

- A. Contractor shall provide factory supplied roof curb, 16 gauge perimeter made of zinc coated steel with supply and return air gasketing and wood nailer strips. Ship knocked down and provided with instructions for easy assembly.
- B. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Contractor shall verify that roof is ready to receive work and opening dimensions are as shown on plans.
- B. Contractor shall verify that proper power supply is available.

3.02 INSTALLATION

- A. Contractor shall install in accordance with manufacturer's instructions.
- B. Mount units on factory built roof mounting frame providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.
- C. The contractor shall furnish manufacturer complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION

HVAC Guide Specifications
Single Evaporator, Direct Expansion (DX), Air-Cooled, Variable Capacity, Split System

Section 15700 – Mechanical HVAC

Size Range:

1.5 to 2.0 tons nominal

Daikin AC Model Number:

RZQ18TAVJU_FAQ18TAVJU

RZQ24TAVJU_FAQ24TAVJU

Part 1 – GENERAL

SINGLE SPLIT (SkyAir) AIR CONDITIONING
SPECIFICATION – Heat Pump

1.01 SYSTEM DESCRIPTION

The variable capacity, cooling only air conditioning system shall be a Daikin inverter driven SkyAir series split system. The system shall consist of a wall mounted indoor evaporator model exclusively matched to the outdoor condensing unit model as follows:

Outdoor Model	Indoor Model
RZQ18TAVJU	FAQ18TAVJU
RZQ24TAVJU	FAQ24TAVJU

The RZR outdoor condensing unit models shall be a direct expansion (DX), air-cooled cooling only air-conditioning system, with a variable speed inverter driven compressor & fan motor using R-410A refrigerant. The outdoor unit is a horizontal discharge, variable speed, single fan unit using a single phase power supply.

1.02 QUALITY ASSURANCE

- A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.
- B. All wiring shall be in accordance with the National Electric Code (NEC).
- C. The system shall be rated in accordance with Air Conditioning Refrigeration Institute's (ARI) Standard 210/240 and bear the ARI label.
- D. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.
- E. The outdoor unit will be factory charged with R-410A.
- F. A holding charge of dry nitrogen shall be provided in the evaporator.
- G. System efficiency shall meet or exceed 17.0 SEER, 10.2 EER and 8.2 HSPF.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit shall be stored and handled according to the manufacturer's recommendations.

Part 2 – WARRANTY

2.01 LIMITED WARRANTY

Daikin North America LLC (“Daikin”) warrants to the customer who is the original owner and user of the Daikin products specified above (“Customer”) that under normal use and maintenance for comfort cooling and conditioning applications such products (the “Products”) will be free from defects in material or workmanship. Warranty coverage begins on the “installation date.”

- A. Residential Installations: The installation date is one of three dates depending on the circumstances of purchase: (1) For units installed in a newly constructed residence, the installation date is the date the owner purchases the residence from the builder. (2) For units installed in existing residences, the installation date is the date that the unit is originally installed. (3) If the date the owner purchases the residence from the builder or the date the unit is originally installed cannot be verified, the installation date is three months after the manufacture date noted on the unit. The warranty lasts for a period up to 10 YEARS.
- B. Commercial Installations: The installation date is one of two dates: (1) The installation date is the date that the unit is originally installed. (2) If the date the unit is originally installed cannot be verified, the installation date is three months after the manufacture date. The warranty lasts for a period up to 10 YEARS.

2.02 INSTALLATION REQUIREMENTS

Installation must comply with installation manual. It is recommended the system be installed by a contractor/dealer who has been through Daikin training programs.

Part 3 – PERFORMANCE

3.01 PERFORMANCE

The system performance shall be in accordance with ARI 210/240 test conditions as shown in the performance table below:

System Model	Cooling Capacity	Heating Capacity	SEER	EER	HSPF
RZQ18TAVJU FAQ18TAVJU	18,000	20,000	17.0	11.9	8.2
RZQ24TAVJU FAQ24TAVJU	24,000	27,000	17.6	10.2	8.4

The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB / 75°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference. The heating performance is based on 70°F DB / 60°F WB for the indoor unit and 47°F DB / 43°F WB for the outdoor unit with 25ft of interconnecting pipe-work & 0ft level difference.

3.02 COOLING OPERATING RANGE

The operating range in cooling will be 23°F DB ~ 122°F DB and 0°F DB ~ 115°F DB when used with an optional wind baffle.

3.03 HEATING OPERATING RANGE

The operating range in heating will -4°F WB – 60°F WB.

3.03 REFRIGERANT PIPING

The system shall be capable of refrigerant piping up to 164 total feet with a 98 feet maximum vertical difference, without any oil traps or additional components.

Part 4 – PRODUCTS

4.01 OUTDOOR UNIT

- A. General: The outdoor condensing unit is designed specifically for use with matched capacity (e.g. RZQ24TAVJU/FAQ24TAVJU) SkyAir series indoor evaporator units.
1. The outdoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. The refrigeration circuit of the condensing unit shall consist of a Daikin swing compressor, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4 way valve, distribution headers, capillaries, filters, shut off valves, service ports and suction accumulator.
 2. Both liquid and suction lines must be individually insulated between the outdoor and indoor units.
 3. The outdoor unit can be wired and piped in the front, lateral or downward directions, accessed from the right side of the unit.
 4. The sound pressure level standard shall be that value as listed in the Daikin engineering manual for the specified models at 3 feet from the front of the unit.
 5. The system will automatically restart operation after a power failure and will not cause any settings to be lost, thus eliminating the need for re-programming.
 6. The outdoor unit shall be modular in design and should allow for side-by-side installation with minimum spacing.
 7. The following safety devices shall be included on the condensing unit; high pressure switch, outdoor fan driver overload protector, inverter overload protector, fusible plugs, fuses.
 8. Each condensing unit shall utilize an algorithm to automatically adjust the refrigerant suction and condensing temperatures in response to the heating and cooling loads, and in response to the current weather conditions. The VRT control shall be capable of being customized in the following modes and sub modes:
 - i. Automatic (factory preset) – The Automatic VRT control shall allow the target evaporator temperature (Te) and target condensing temperature (Tc) to float based on outdoor ambient temperature conditions, and shall incorporate the following sub-modes:
 1. Powerful
 2. Quick
 3. Mild (factory preset)
 - ii. High Sensible – The High Sensible mode shall allow the system Te and Tc values to be programmed to series of fixed Te and Tc values. The High Sensible mode shall also be capable of incorporating the following sub-modes:
 1. Eco
 - iii. Basic – The Basic mode shall disable the VRT control of the outdoor unit and allow the system to operate with constant Te and Tc values.
- B. Unit Cabinet:
1. The outdoor unit model RZQ__TAVJU shall be completely weatherproof and corrosion resistant. The unit shall be constructed from rust-proofed mild steel panels coated with a baked enamel finish.

2. The outdoor unit will come furnished with four (4) mounting feet, mounted across the base pan, to allow bolting to a cement pad or optionally supplied mounting bracket.

C. Fan:

1. The condensing unit shall consist of one propeller type, direct-drive 70 W fan motor that has multiple speed operation via a DC (digitally commutating) inverter.

Model Number	Fan Motor Output (W) & Quantity
RZQ18TAVJU	200 x 1
RZQ24TAVJU	200 x 1

2. The fan shall be a horizontal discharge configuration with a nominal airflow maximum of 2,682 cfm.
3. The fan motor shall have inherent protection and permanently lubricated bearings and be mounted.
4. The fan motor shall be provided with a fan guard to prevent contact with moving parts.

D. Condenser Coil:

1. The condenser coil shall be manufactured from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The heat exchanger coil shall be of a waffle louver fin and rifled bore tube design to ensure highly efficient performance.
3. The heat exchanger on the condensing units shall be manufactured from Hi-X seamless copper tube.
4. The fins are to be covered with an anti-corrosion acrylic resin and hydrophilic film type E1 rated for up to 1000 hours salt spray.
5. The pipe plates shall be treated with powdered polyester resin for corrosion prevention. The thickness of the coating must be between 2.0 to 3.0 microns.

E. Compressor:

1. The Daikin swing compressor shall be variable speed (PAM inverter) controlled which is capable of changing the speed to follow the variations in total cooling load as determined by the suction gas pressure as measured in the condensing unit. In addition, samplings of evaporator and condenser temperatures shall be made so that the high/low pressures detected are read every 20 seconds and calculated. With each reading, the compressor capacity shall be controlled to eliminate deviation from target value.
2. The inverter driven compressor shall be of highly efficient reluctance DC (digitally commutating), hermetically sealed swing type.
3. Neodymium magnets shall be adopted in the rotor construction to yield a higher torque and efficiency in the compressor instead of the normal ferrite magnet type. At complete stop of the compressor, the neodymium magnets will position the rotor into the optimum position for a low torque start.
4. The capacity control range shall be as shown below:

Model Number	Capacity Control Range
RZQ18TAVJU	14-100%
RZQ24TAVJU	14-100%

5. The compressor shall be equipped with a crankcase heater, high pressure safety switch, and internal thermal overload protector.
 6. The compressor shall be mounted to avoid the transmission of vibration.
- F. Electrical:
1. The power supply to the outdoor unit shall be 208-230 volts, 1 phase, 60 hertz +/- 10%.

Power Supply Voltage	Voltage Range
208-230V/1/60	187V-253V

Model	MCA	MOP
RZQ18TAVJU	16.5	25
RZQ24TAVJU	16.5	25

2. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded, stranded 2 conductor cable.
3. The control wiring shall be a two-wire multiplex transmission system.
4. The control wiring lengths shall be as shown below:

	Outdoor to Indoor Unit	Indoor Unit to Remote Control
Control Wiring Length	3,280	1,640
Wire Type	18 AWG, 2 wire, non-polarity, non-shielded, stranded	

4.02 FAQ INDOOR UNIT – WALL MOUNTED UNIT

A. General:

Daikin indoor unit model FAQ shall be a wall mounted fan coil unit, operable with R-410A refrigerant, equipped with an electronic expansion valve, for installation onto a wall within a conditioned space. It shall be available in capacities from 18,000 Btu/h to 24,000 Btu/h. Model numbers are FAQ18TAVJU and FAQ24TAVJU to be connected to the corresponding SkyAir series outdoor condensing unit model RZQ18TAVJU and RZQ24TAVJU. Computerized PID control shall be used to control superheat to deliver a comfortable room temperature condition. The unit shall be equipped with a programmed drying mechanism that dehumidifies while limiting changes in room temperature when used with Daikin remote control BRC2A71, BRC1E73 and BRC7E818. A mildew-proof, polystyrene condensate drain pan and resin net mold resistant filter shall be included as standard equipment. The indoor units sound pressure shall range from 37 dB(A) to 41 dB(A) at low speed measured at 3.3 feet below and from the unit.

B. Performance: Each units performance is based on nominal operating conditions:

Model Number	Cooling (Indoor 80°F DB / 67°F WB, Outdoor 95°F DB, 25 ft pipe length)	Heating (Indoor 70°F DB / 60°F WB, Outdoor 47°F DB, 25 ft pipe length)
FAQ18TAVJU	18,000	20,000
FAQ24TAVJU	24,000	27,000

C. Indoor Unit:

1. The Daikin indoor unit FAQ shall be completely factory assembled and tested. Included in the unit is factory wiring, piping, electronic proportional expansion valve, control circuit board, fan motor thermal protector, flare connections, condensate drain pan, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch. The unit shall have an auto-swing louver which ensures efficient air distribution, which closes automatically when the unit stops. The remote controller shall be able to set five (5) steps of discharge angle. The discharge angle shall automatically set at the same angle as the previous operation upon restart. The front grille shall be easily removed for washing. The drain pipe can be fitted to from either left or right sides.
2. Indoor unit and refrigerant pipes will be charged with dehydrated air prior to shipment from the factory.
3. Both refrigerant lines shall be insulated from the outdoor unit.
4. Return air shall be through the a resin net mold resistant filter.
5. The indoor units shall be equipped with a condensate pan.
6. The indoor units shall be equipped with a return air thermistor.
7. The indoor unit will be separately powered with 208~230V/1-phase/60Hz.
8. The voltage range will be 253 volts maximum and 187 volts minimum.

D. Unit Cabinet:

1. The cabinet shall be affixed to a factory supplied wall mounting template and located in the conditioned space.
2. The cabinet shall be constructed with sound absorbing foamed polystyrene and polyethylene insulation.

E. Fan:

1. The fan shall be direct-drive turbo fan type with statically and dynamically balanced impeller with high and low fan speeds available.
2. The fan motor shall operate on 208/230 volts, 1 phase, 60 hertz with a motor output of 43 W.
3. The airflow rate shall be available in high and low settings.
4. The fan motor shall be thermally protected.

F. Coil:

1. Coils shall be of the direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond.
2. The coil shall be of a waffle louver fin and high heat exchange, rifled bore tube design to ensure highly efficient performance.
3. The coil shall be a 2-row cross fin copper evaporator coil with 14 FPI design completely factory tested.
4. The refrigerant connections shall be flare connections and the condensate will be 11/16 inch outside diameter PVC.
5. A thermistor will be located on the liquid and gas line.
6. A condensate pan shall be located in the unit.

G. Electrical:

1. A separate power supply will be required of 208-230 volts, 1 phase, 60 hertz. The acceptable voltage range shall be 187 to 253 volts.
2. Transmission (control) wiring between the indoor and outdoor unit shall be a maximum of 3,280 feet.
3. Transmission (control) wiring between the indoor unit and remote controller shall be a maximum distance of 1,640 feet.

H. Control:

1. The unit shall have controls provided by Daikin to perform input functions necessary to operate the system.
 2. A full array of fault diagnostics shall be accessible via the remote controller.
 3. The unit shall be compatible with interfacing with connection to BACnet and LonWorks networks or interfacing with connection to BMS system. Consult with Daikin prior to applying controls.
 4. The unit shall be compatible with a Daikin Intelligent touch Manager advanced multi-zone controller.
- I. Accessories Available:
1. Remote “in-room” sensor kit (KRCS01-4B)
 2. Navigation Remote Controller (BRC1E73)
 3. Simplified Wired Controller (BRC2A71)
 4. Handheld I/R Remote Controller (BRC7E818)
 5. DKN Cloud Wi-Fi Adapter (AZAI6WSCDKA)

End of Section

Division	Section Title
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SPECIFICATIONS GROUP

DIVISION 26 - ELECTRICAL

260519	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
260526	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
260529	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
260533	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
260544	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
260553	IDENTIFICATION FOR ELECTRICAL SYSTEMS
260923	LIGHTING CONTROL DEVICES
262413	SWITCHBOARDS
262416	PANELBOARDS
262726	WIRING DEVICES
262813	FUSES
262816	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
265119	LED INTERIOR LIGHTING
265219	EMERGENCY AND EXIT LIGHTING
265600	EXTERIOR LIGHTING

END OF TABLE OF CONTENTS

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- B. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THW-2 Type THHN/THWN-2 Type XHHW-2 Type UF Type USE and Type SO.
- C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC metal-clad cable, Type MC Type SO and Type USE with ground wire.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 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 NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway Armored cable, Type AC Metal-clad cable, Type MC.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway Armored cable, Type AC Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- 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."

3.4 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.
 - 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 inches (150 mm) of slack.

3.5 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.

3.6 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."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Perform the following 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 visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test and Inspection Reports: Prepare a written report 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.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 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.

2.2 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.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 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 inches (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 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.3 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. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.

- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor.
 - 1. Bury at least 24 inches (600 mm) below grade.
- C. 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.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Follow Payson City Power Requirements.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.

3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. 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.
- E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- F. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
 3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 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 Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (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. For grounding electrode system, install at least 2 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.
- 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. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 ACTION SUBMITTALS

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
 - 1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 - 2. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. 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] [stainless] steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
 - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
 - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 - 6. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel.

2.2 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 Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.
- C. 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.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. 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)**.
- D. 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 inches (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
 - 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.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "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.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (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 4000psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 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.

3.5 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 Section 099123 "Interior Painting" 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.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Surface raceways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

1.2 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
1. Structural members in paths of conduit groups with common supports.
 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.

- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. FMC: Comply with UL 1; zinc-coated steel or aluminum.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel or die cast.
 - b. Type: Setscrew or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- I. 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.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ENT: Comply with NEMA TC 13 and UL 1653.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.
- E. Continuous HDPE: Comply with UL 651B.
- F. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- G. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- H. Fittings for LFNC: Comply with UL 514B.
- I. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- J. Solvent cements and adhesive primers 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."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 Type 3R Type 4 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. 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.

2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- E. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- F. Solvent cements and adhesive primers 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."

2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Metal Floor Boxes:
 - 1. Material: Cast metal or sheet metal.
 - 2. Type: Fully adjustable.
 - 3. Shape: Rectangular.
 - 4. Listing and Labeling: 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. Nonmetallic Floor Boxes: Nonadjustable, round or rectangular.
 - 1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- H. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing **70 lb (32 kg)**.
 - 1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- I. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- J. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- K. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- L. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**.
- M. Gangable boxes are allowed.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 Type 3R 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. Nonmetallic Enclosures: Plastic or Fiberglass.

3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

O. Cabinets:

1. NEMA 250, Type 1, Type 3R, or Type 12 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.

2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete, reinforced concrete, cast iron, or fiberglass.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, or direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated.
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT RNC identified for such use.
 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC or IMC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.
- D. Raceway Fittings: Compatible with raceways 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. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use setscrew or compression, fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).
- 3.2 INSTALLATION
- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

- B. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- D. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- E. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches (300 mm)** of changes in direction.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- H. Raceways 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 raceways to reinforcement at maximum **10-foot (3-m)** intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways 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 ENT to GRC or IMC before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- L. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- M. 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.
- N. Install pull wires in empty raceways. 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. Cap underground raceways designated as spare above grade alongside raceways in use.

O. Surface Raceways:

1. Install surface raceway with a minimum **2-inch (50-mm)** radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

Q. 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 the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

R. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed **30 deg F (17 deg C)** and that has straight-run length that exceeds **25 feet (7.6 m)**.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - 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 degree F (0.06 mm per meter of length of straight run per degree C)** of temperature change for PVC conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

S. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

T. 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 top of box unless otherwise indicated.

- U. 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 the box and cover plate or the supported equipment and box.
- V. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- W. Locate boxes so that cover or plate will not span different building finishes.
- X. 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.
- Y. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- Z. Set metal floor boxes level and flush with finished floor surface.
- AA. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 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 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 duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. 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 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.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 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 handholes with bottom below frost line, below grade.
- 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.

3.5 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."

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway 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. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products 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."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

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. Sleeves for Rectangular Openings:

1. Material: Galvanized sheet steel.
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).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 1. Sealing Elements: EPDM or Nitrile (Buna N) rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Carbon steel.
 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 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.

2.4 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.

2.5 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 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

3.1 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 raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "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 raceway 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 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 raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron 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 raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- 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.

3.3 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 260544

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for conductors.
 - 2. Underground-line warning tape.
 - 3. Warning labels and signs.
 - 4. Instruction signs.
 - 5. Equipment identification labels.
 - 6. Miscellaneous identification products.

1.2 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI 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. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE,.

3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE,.

2.2 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 2. **1/4-inch (6.4-mm)** grommets in corners for mounting.
 3. Nominal size, **7 by 10 inches (180 by 250 mm)**.
- D. Metal-Backed, Butyrate Warning Signs:
 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)** galvanized-steel backing; and with colors, legend, and size required for application.
 2. **1/4-inch (6.4-mm)** grommets in corners for mounting.
 3. Nominal size, **10 by 14 inches (250 by 360 mm)**.
- E. Warning label and sign 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)**."

2.3 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum **1/16 inch (1.6 mm)** thick for signs up to **20 sq. inches (129 sq. cm)** and **1/8 inch (3.2 mm)** thick for larger sizes.
 1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.4 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be **3/8 inch (10 mm)**. Overlay shall provide a weatherproof and UV-resistant seal for label.
- B. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be **3/8 inch (10 mm)**.
- C. Stenciled Legend: In nonfading, waterproof, ink or paint. Minimum letter height shall be **1 inch (25 mm)**.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select 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

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line 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.
- F. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

- a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Conductors to Be Extended in the Future: Attach write-on tags or marker tape to conductors and list source.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
- 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
- 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. 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.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment: Adhesive film label. 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.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Time switches.
2. Photoelectric switches.
3. Indoor occupancy switchbox-mounted occupancy and outdoor motion sensors.

B. Related Requirements:

1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Programs: Eight on-off set points on a 24-hour schedule.
5. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week.

- B. Electromechanical-Dial Time Switches: Comply with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: SPST.
3. Contact Rating: 20-A ballast load, 120-/240-V ac.
4. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
5. Astronomic time dial.
6. Eight-Day Program: Uniquely programmable for each weekday and holidays.
7. Skip-a-day mode.
8. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range.
 3. Time Delay: Thirty-second minimum, to prevent false operation.
 4. Lightning Arrester: Air-gap type.
 5. Mounting: Twist lock complying with NEMA C136.10, with base.

2.3 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
 5. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

- B. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
 - 1. Detector Sensitivity: Detect occurrences of **6-inch- (150-mm-)** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in. (232 sq. cm)**.
 - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.
 - 3. Detection Coverage (Corridor): Detect occupancy within **90 feet (27.4 m)** when mounted on a **10-foot- (3-m-)** high ceiling.
- C. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
 - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than **12 inches (305 mm)** in either a horizontal or a vertical manner at an approximate speed of **12 inches/s (305 mm/s)**.
 - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of **600 sq. ft. (56 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.
 - 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of **2000 sq. ft. (186 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.
 - 5. Detection Coverage (Corridor): Detect occupancy anywhere within **90 feet (27.4 m)** when mounted on a **10-foot- (3-m-)** high ceiling in a corridor not wider than **14 feet (4.3 m)**.
- D. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
 - 1. Sensitivity Adjustment: Separate for each sensing technology.
 - 2. Detector Sensitivity: Detect occurrences of **6-inch- (150-mm-)** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in. (232 sq. cm)**, and detect a person of average size and weight moving not less than **12 inches (305 mm)** in either a horizontal or a vertical manner at an approximate speed of **12 inches/s (305 mm/s)**.
 - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.

2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Operating Ambient Conditions: Dry interior conditions, **32 to 120 deg F (0 to 49 deg C)**.
 - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- B. Wall-Switch Sensor Tag WS1:
 - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of **[900 sq. ft. (84 sq. m)] [2100 sq. ft (196 sq. m)]**.
 - 2. Sensing Technology: Dual technology - PIR and ultrasonic.

3. Switch Type: SP, manual "on," automatic "off." SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage;
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

C. Wall-Switch Sensor Tag WS2:

1. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
2. Sensing Technology: PIR.
3. Switch Type: SP. SP, manual "on," automatic "off." SP, field selectable automatic "on," or manual "on" automatic "off."
4. Voltage: Match the circuit voltage;
5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
7. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.
8. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

2.5 OUTDOOR MOTION SENSORS

A. General Requirements for Sensors: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Dual-technology (PIR and infrared) type, weatherproof. Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm). Comply with UL 773A.
3. Switch Rating:
 - a. Lighting-Fixture-Mounted Sensor: .
 - b. Separately Mounted Sensor: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
4. Voltage: Match the circuit voltage type.
5. Detector Coverage:
 - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).
 - b. Long Range: 180-degree field of view and 110-foot (34-m) detection range.
6. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc (108 to 1600 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
7. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
8. Concealed "off" time-delay selector at 30 seconds, and 5, 10, and 20 minutes.

9. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
10. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from **minus 40 to plus 130 deg F** (**minus 40 to plus 54 deg C**), rated as "raintight" according to UL 773A.

2.6 LIGHTING CONTACTORS

- A. Description: Electrically operated and electrically held, combination-type lighting contactors with, complying with NEMA ICS 2 and UL 508.
 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

2.7 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to 1 visits to Project during other-than-normal occupancy hours for this purpose.
 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
- C. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

- D. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- E. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate lighting control devices and perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 260923

SECTION 262413 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

1.2 ACTION SUBMITTALS

A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Detail utility company's metering provisions with indication of approval by utility company.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
9. Include schematic and wiring diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For switchboards, overcurrent protective devices, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

- B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by NFPA 70E.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL.

1.6 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 - 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
 - b. Altitude: Not exceeding 6600 feet (2000 m).

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, buswork, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer's agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.

2.2 SWITCHBOARDS

- A. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards including clearances between switchboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Comply with NEMA PB 2.
- D. Comply with NFPA 70.
- E. Comply with UL 891.
- F. Front-Connected, Front-Accessible Switchboards:
 1. Main Devices: Panel mounted.
 2. Branch Devices: Panel mounted.
 3. Sections front and rear aligned.
- G. Nominal System Voltage: 208Y/120 V.
- H. Main-Bus Continuous: per plans
- I. Seismic Requirements: Fabricate and test switchboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation. Shake-table testing shall comply with ICC-ES AC156.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 - b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
- J. Indoor Enclosures: Steel, NEMA 250, Type 1.
- K. Outdoor Enclosures: Type 3R.
 1. Finish: Factory-applied finish in manufacturer's standard color; undersurfaces treated with corrosion-resistant undercoating.
 2. Enclosure: Flat roof; for each section, with provisions for padlocking.
- L. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.

- M. Utility Metering Compartment: Barrier compartment and section complying with utility company's requirements; hinged sealable door; buses provisioned for mounting utility company's current transformers and potential transformers or potential taps as required by utility company. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- N. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- O. Removable, Hinged Rear Doors and Compartment Covers: Secured by standard bolts, for access to rear interior of switchboard.
- P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- Q. Pull Box on Top of Switchboard:
 - 1. Adequate ventilation to maintain temperature in pull box within same limits as switchboard.
 - 2. Set back from front to clear circuit-breaker removal mechanism.
 - 3. Removable covers shall form top, front, and sides. Top covers at rear shall be easily removable for drilling and cutting.
 - 4. Bottom shall be insulating, fire-resistive material with separate holes for cable drops into switchboard.
 - 5. Cable supports shall be arranged to facilitate cabling and adequate to support cables indicated, including those for future installation.
- R. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
 - 2. Phase- and Neutral-Bus Material: Tin-plated, high-strength, electrical-grade aluminum alloy with tin-plated aluminum circuit-breaker line connections.
 - 3. Tin-plated aluminum feeder circuit-breaker line connections.
 - 4. Load Terminals: Insulated, rigidly braced, runback bus extensions, of same material as through buses, equipped with mechanical connectors for outgoing circuit conductors. Provide load terminals for future circuit-breaker positions at full-ampere rating of circuit-breaker position.
 - 5. Ground Bus: ~~1/4-by-1-inch-~~ (6-by-25-mm-) hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
 - 6. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 7. Disconnect Links:
 - a. Isolate neutral bus from incoming neutral conductors.
 - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 - 8. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with mechanical connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- S. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.3 SURGE PROTECTION DEVICES

- A. SPDs: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449,
 - 1. SPDs with the following features and accessories:
 - a. Integral disconnect switch.
 - b. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - c. Indicator light display for protection status.
- B. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 200 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
- C. Protection modes and UL 1449 VPR for grounded wye circuits with 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 208Y/120 V.
 - 3. Line to Line: 1000 V for 208Y/120 V.
- D. Protection modes and UL 1449 VPR for 240/120 V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 700 V.
 - 3. Line to Line: 1000 V.
- E. SCCR: Equal or exceed 100 kA.
- F. Nominal Rating: 20 kA.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current 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.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.
 6. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 7. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 8. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
 - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- B. Insulated-Case Circuit Breaker (ICCB): 80 percent rated, sealed, insulated-case power circuit breaker with interrupting capacity rating to meet available fault current.
1. Fixed circuit-breaker mounting.
 2. Two-step, stored-energy closing.
 3. Standard-function, microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Time adjustments for long- and short-time pickup.
 4. Control Voltage: 120-V ac.
- C. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
 2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.
 3. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 4. Service-Rated Switches: Labeled for use as service equipment.
 5. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- D. High-Pressure, Butt-Type Contact Switch: Operating mechanism uses butt-type contacts and a spring-charged mechanism to produce and maintain high-pressure contact when switch is closed.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
 2. Main-Contact Interrupting Capability: Minimum of 12 times the switch current rating.
 3. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 - a. Electrical Trip: Operation of lever or push-button trip switch, or trip signal from ground-fault relay or remote-control device, causes switch to open.
 - b. Mechanical Trip: Operation of mechanical lever, push button, or other device causes switch to open.
 4. Auxiliary Switches: Factory installed, SPDT, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 5. Service-Rated Switches: Labeled for use as service equipment.
 6. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- E. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- F. Fuses are specified in Section 262813 "Fuses."

2.5 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
 2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound bushing bar or window type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
 3. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kVA.
 4. Current Transformers for Neutral and Ground-Fault Current Sensing: Connect secondary wiring to ground overcurrent relays, via shorting terminals, to provide selective tripping of main and tie circuit breaker. Coordinate with feeder circuit-breaker, ground-fault protection.

2.6 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control-power transformer.
- B. Electrically Interlocked Main and Tie Circuit Breakers: Two control-power transformers in separate compartments, with interlocking relays, connected to the primary side of each control-power transformer at the line side of the associated main circuit breaker. 120-V secondaries connected through automatic transfer relays to ensure a fail-safe automatic transfer scheme.
- C. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- D. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with requirements in Section 260548.16 "Seismic Controls for Electrical Systems" or manufacturer's instructions.

2.8 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
- B. Install switchboards and accessories according to NEMA PB 2.1.
- C. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches (50-mm) above concrete base after switchboard is anchored in place.
 - 2. 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.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to switchboards.
 - 6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
- E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- F. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- G. Install filler plates in unused spaces of panel-mounted sections.
- H. Install overcurrent protective devices, surge protection devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges.
 - I. Install spare-fuse cabinet.
 - J. Comply with NECA 1.
 - K. Comply with requirements for terminating feeder bus specified in Section 262500 "Enclosed Bus Assemblies." Drawings indicate general arrangement of bus, fittings, and specialties.
 - L. Comply with requirements for terminating cable trays specified in Section 260536 "Cable Trays for Electrical Systems." Drawings indicate general arrangement of cable trays, fittings, and specialties.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Acceptance Testing:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard, and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Switchboard will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 262413

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

- A. MCCB: Molded-case circuit breaker.
- B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
- B. Shop Drawings: For each panelboard and related equipment.
1. Include dimensioned plans, elevations, sections, and details.
 2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 3. Detail bus configuration, current, and voltage ratings.
 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 5. Include evidence of NRTL listing for series rating of installed devices.
 6. Include evidence of NRTL listing for SPD as installed in panelboard.
 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 8. Include wiring diagrams for power, signal, and control wiring.
 9. Key interlock scheme drawing and sequence of operations.
 10. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

- A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."
- 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.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R.
 - d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
 - 2. Height: 84 inches (2.13 m) maximum.
 - 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 - 4. 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.
- F. Incoming Mains Location: Convertible between top and bottom.
- G. Phase, Neutral, and Ground Buses: Tin-plated aluminum.
- H. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Tin-plated aluminum.

2. Main and Neutral Lugs: Compression or Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 3. Ground Lugs and Bus-Configured Terminators: Compression or type, with a lug on the bar for each pole in the panelboard.
 4. Feed-Through Lugs: Compression or Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 5. Subfeed (Double) Lugs: Compression or 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 shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - K. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.
 - L. 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.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 POWER PANELBOARDS

- A. Panelboards: NEMA PB 1, distribution type.
- B. 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.
- C. Mains: per plans
- D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices: Fused switches.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker or lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Single row of overcurrent devices with narrow gutter extension and overhead junction box equipped with ground and neutral terminal buses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. 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.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 - 8. Subfeed Circuit Breakers: Vertically mounted.
 - 9. 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: Compression or Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
 - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."

2.6 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: Directory card inside panelboard door, mounted in transparent card holder.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.
- 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. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.
- H. 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.
- I. Install filler plates in unused spaces.
- J. Stub four 1-inch (27-EMT) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-EMT) empty conduits into raised floor space or below slab not on grade.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 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.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.

- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on Masterworks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on Masterworks/Supporting Information.

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Weather-resistant receptacles.
3. Snap switches and wall-box dimmers.
4. Solid-state fan speed controls.
5. Wall-switch and exterior occupancy sensors.
6. Communications outlets.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 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 application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
 - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
 - 2. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
 - 1. Single Pole:
 - 2. Two Pole:
 - 3. Three Way:
 - 4. Four Way:
- C. Pilot-Light Switches, 20 A:
 - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

- D. Key-Operated Switches, 120/277 V, 20 A:
 - 1. Description: Single pole, with factory-supplied key in lieu of switch handle.

2.6 DECORATOR-STYLE DEVICES

- A. Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
- B. GFCI, Feed-Through Type, Convenience Receptacles: Square face, 125 V, 15 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
- C. Toggle Switches, Square Face, 120/277 V, 15 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- D. Lighted Toggle Switches, Square Face, 120 V, 15 A: Comply with NEMA WD 1 and UL 20.
 - 1. Description: With neon-lighted handle, illuminated when switch is "off."

2.7 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.8 FINISHES

- A. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
 - 2. Wiring Devices Connected to Emergency Power System: Red.
 - 3. TVSS Devices: Blue.
- B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 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:

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 meet provisions of 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 down, 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. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.

3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. 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.
- I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. Test Instruments: Use instruments that comply with UL 1436.
 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 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.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 2. Type RK-5: 250 or 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, time delay.
 4. Type CD: 600-V, 31- to 60-A rating, 200 kAIC, time delay.
 5. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 6. Type L: 600-V, 601- to 6000-A rating, 200 kAIC, time delay.
 7. Type T: 250-V, zero- to 1200-A 600-V, zero- to 800-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.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.2 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

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Enclosures.

1.2 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.7 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. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- B. Type HD, Heavy Duty, Single Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Six Pole, Single Throw, 240 or 600-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Double Throw, 240 or 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. 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. Lugs: Suitable for number, size, and conductor material.
 - 5. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

- A. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

- B. Type HD, Heavy Duty, Single Throw, 240-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, Six Pole, Single Throw, 240-V ac, 200 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. Type HD, Heavy Duty, Double Throw, 240-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.
- E. 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. Lugs: Suitable for number, size, and conductor material.

2.3 RECEPTACLE SWITCHES

- A. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- B. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240 or 600-V ac, 30 60 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

2.4 SHUNT TRIP SWITCHES

- A. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- B. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- D. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight ON pilot light.
3. Isolated neutral lug.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current 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.
- C. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 1. Instantaneous trip.
 2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I²t response.
- D. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- E. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Suitable for number, size, trip ratings, and conductor material.
 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 6. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
 7. Alarm Switch: One NO NC contact that operates only when circuit breaker has tripped.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.
 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 3Rp.

4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.2 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.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- C. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 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.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire 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.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved:
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE 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. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 70. CCT of 4000.
- F. Rated lamp life of 35,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: per plans
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.2 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers, and Globes:

1. Per plans

D. Housings:

2.3 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.4 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports: Sized and rated for luminaire weight.

- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with two **5/32-inch- (4-mm-)** diameter aircraft cable supports adjustable to **120 inches ((6 m))** in length.
 - 2. Ceiling mount with pendant mount with **5/32-inch- ((4-mm-))** diameter aircraft cable supports adjustable to **120 inches ((6 m))** in length.
 - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.
- K. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265119

SECTION 265219 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, coordinated with each other, using input from installers of the items involved:
- B. Product Certificates: For each type of luminaire.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

- D. Sample Warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two year(s) from date of Substantial Completion.
- B. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for recessed luminaires.
- F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.
 - 1. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F (minus 18 deg C) or exceeding 104 deg F (40 deg C), with an average value exceeding 95 deg F (35 deg C) over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C).
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet (1000 m).
 3. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- G. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
1. Emergency Connection: Operate LED lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire.
 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 3. Nightlight Connection: Operate lamp in a remote fixture continuously.
 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
 5. Charger: Fully automatic, solid-state, constant-current type.
 6. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the emergency power unit manufacturer, whichever is less.
 7. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 8. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.3 EMERGENCY LIGHTING

- A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires:

1. Emergency Luminaires: as indicated on Interior Lighting Fixture Schedule Drawings, with the following additional features:
 - a. Operating at nominal voltage of 120 V ac.
 - b. Internal or External emergency power unit.
 - c. Rated for installation in damp locations, and for sealed and gasketed fixtures in wet locations.
 - d. UL 94 flame rating.

C. Emergency Lighting Unit:

1. Emergency Lighting Unit: as indicated on Interior Lighting Fixture Schedule Drawings.
2. Operating at nominal voltage of 120 V ac.
3. Wall or ceiling mounted with universal junction box adaptor.
4. UV stable thermoplastic housing, rated for damp locations.
5. Two LED lamp heads.
6. Internal or External emergency power unit.
7. External emergency power unit.

2.4 EXIT SIGNS

A. Internally Lighted Signs:

1. Operating at nominal voltage of 120 V ac.
2. Lamps for AC Operation: Fluorescent, two for each fixture; 20,000 hours of rated lamp life.
3. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
4. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:

1. Clear, UV-stabilized acrylic.
2. Glass: Annealed crystal glass unless otherwise indicated.
3. Acrylic: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
4. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

2.6 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire and emergency power unit weight.
 - 2. Able to maintain luminaire position when testing emergency power unit.
 - 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members in walls.
 - 2. Do not attach fixtures directly to gypsum board.
- F. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of fixture oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Ceiling Grid Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

- H. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 265219

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.

1.2 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4-M.
- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.
- C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.
- D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculated and applied as stated in AASHTO LTS-4-M.
1. Basic wind speed for calculating wind load for poles exceeding 49.2 feet (15 m) in height is 100 mph (45 m/s).
 - a. Wind Importance Factor: 1.0.
 2. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s).
 - a. Wind Importance Factor: 1.0.

1.3 ACTION SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, and finishes.
- B. Shop Drawings: Anchor-bolt templates keyed to specific poles and certified by manufacturer.

1.4 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. Comply with IEEE C2, "National Electrical Safety Code."
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, product(s) indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
 - 1. LER Tests Incandescent Fixtures: Where LER is specified, test according to NEMA LE 5A.
 - 2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.
- B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.
- F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
 - 1. White Surfaces: 85 percent.
 - 2. Specular Surfaces: 83 percent.
 - 3. Diffusing Specular Surfaces: 75 percent.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

- M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected from manufacturer's standard catalog of colors.
 - b. Color: Match Architect's sample of manufacturer's standard color.
 - c. Color: As selected by Architect from manufacturer's full range.
- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
 - a. Color: per architect.
- O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
 - a. "USES ONLY" and include specific lamp type.
 - b. Lamp tube configuration (twin, quad, triple), base type, and nominal wattage for compact fluorescent luminaires.
 - c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
 - d. Start type (preheat, rapid start, instant start) compact fluorescent luminaires.
 - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
 - f. CCT and CRI for all luminaires.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.

- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay.

- 1. Relay with locking-type receptacle shall comply with ANSI C136.10.
 - 2. Adjustable window slide for adjusting on-off set points.

2.4 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4-M.
 - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
 - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
 - 1. Materials: Shall not cause galvanic action at contact points.
 - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
 - 3. Anchor-Bolt Template: Plywood or steel.
- D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.
- E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."
- F. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- G. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.5 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
 - 1. Shape: per plans
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- B. Steel Mast Arms: per plans, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
 - 1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with galvanized-steel bolts.
 - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
 - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.
- F. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- G. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- H. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- I. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- J. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
 - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
 - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
 - a. Color: As selected by Architect from manufacturer's full standard range.

2.6 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
 - 1. Shape: per plans.
 - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

2.7 WOOD POLES

- A. Poles: Douglas fir or Southern yellow pine, complying with ANSI O5.1 and with AWPA C4 for wood species used; and bored, roofed, and galled before treatment.
 - 1. Mounting Provisions: Embedded.
- B. Preservative Treatment: Pressure treat poles with creosote , pentachlorophenol , or ammoniacal copper arsenate according to AWPA C1 and AWPA C4.
- C. Luminaire Brackets: Comply with ANSI C136.13.

2.8 POLE ACCESSORIES

- A. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.
- B. Verify availability of decorative accessories with specified pole manufacturers.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
 - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

- A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
 2. Water, Gas, Electric, Communication, and Sewer Lines:
 3. Trees: 15 feet (5 m) from tree trunk.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
 3. Install base covers unless otherwise indicated.
 4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Dig holes large enough to permit use of tampers in the full depth of hole.
 2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.
- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
 3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).
- ### 3.3 CORROSION PREVENTION
- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.
- B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

- A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole unless otherwise indicated.
 - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
 - 1. Install grounding electrode for each pole.
 - 2. Install grounding conductor and conductor protector.
 - 3. Ground metallic components of pole accessories and foundations.

END OF SECTION 265600