



# ELECTRICAL PROGRAM RELOCATION

## Ogden Weber Technical College

200 N Washington Blvd  
Ogden, UT 84404  
07 December 2021  
DFCM PROJECT # 22400240

State of Utah - Department of Administration Services  
DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT  
4110 State Office Building - Salt Lake City, Utah 84114 / 801.538.3018



PROJECT MANUAL

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

**OWNER**

**OGDEN WEBER TECHNICAL COLLEGE  
ELECTRICAL PROGRAM RELOCATION**

200 N. Washington Blvd  
Ogden, Utah 84404  
Contact: Josh Ulm, Project Manager

**ARCHITECTURAL**

**SANDERS ASSOCIATES ARCHITECTS**

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**STRUCTURAL**

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**MECHANICAL**

**CUNNING AND ASSOCIATES**

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**ELECTRICAL**

**SINE SOURCE ENGINEERING**

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PROJECT DIRECTORY

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**OGDEN WEBER TECHNICAL COLLEGE  
ELECTRICAL PROGRAM RELOCATION**

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CONTRACT REQUIREMENTS

division 0

**SAA**  
SANDERS ASSOCIATES ARCHITECTS



# AIA® Document A201® – 2017

## General Conditions of the Contract for Construction

**for the following PROJECT:**

*(Name and location or address)*

OWTC Electrical Program Relocation

**THE OWNER:**

*(Name, legal status and address)*

OWTC – Ogden Weber Technical College  
200 North Washington Blvd.  
Ogden, Utah

**THE ARCHITECT:**

*(Name, legal status and address)*

Sanders Associates Architects  
2668 Grant Avenue  
Ogden, Utah

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**ADDITIONS AND DELETIONS:**

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

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1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3,  
13.2, 13.3.2, 15.4.4.2

Written Interpretations  
4.2.11, 4.2.12

Written Orders  
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

## 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;

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- .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

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- .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

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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.



## Application and Certificate for Payment

**TO OWNER:** \_\_\_\_\_ **PROJECT:** \_\_\_\_\_

**FROM CONTRACTOR:** \_\_\_\_\_ **VIA ARCHITECT:** \_\_\_\_\_

**APPLICATION NO:** \_\_\_\_\_ **Distribution to:**

**PERIOD TO:** \_\_\_\_\_ **OWNER:**

**CONTRACT FOR:** \_\_\_\_\_ **ARCHITECT:**

**CONTRACT DATE:** \_\_\_\_\_ **CONTRACTOR:**

**PROJECT NOS:** \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ **FIELD:**

**OTHER:**

### 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 ..... \$ \_\_\_\_\_
2. Net change by Change Orders ..... \$ \_\_\_\_\_
3. CONTRACT SUM TO DATE (Line 1 ± 2) ..... \$ \_\_\_\_\_
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) ..... \$ \_\_\_\_\_
5. RETAINAGE:
  - a. \_\_\_\_\_ % of Completed Work (Column D + E on G703) \$ \_\_\_\_\_
  - b. \_\_\_\_\_ % of Stored Material (Column F on G703) \$ \_\_\_\_\_
6. TOTAL EARNED LESS RETAINAGE ..... \$ \_\_\_\_\_  
(Line 4 Less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT ..... \$ \_\_\_\_\_  
(Line 6 from prior Certificate)

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

8. CURRENT PAYMENT DUE ..... \$

9. BALANCE TO FINISH, INCLUDING RETAINAGE ..... \$

(Line 3 less Line 6)

**AMOUNT CERTIFIED** ..... \$

*(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.)*

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

**ARCHITECT:** \_\_\_\_\_ Date: \_\_\_\_\_

By: \_\_\_\_\_

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





# AIA® Document G704™ – 2000

## Certificate of Substantial Completion

**PROJECT:**  
(Name and address):

**PROJECT NUMBER:** /  
**CONTRACT FOR:**  
**CONTRACT DATE:**

**OWNER:**   
**ARCHITECT:**   
**CONTRACTOR:**   
**FIELD:**   
**OTHER:**

**TO OWNER:**  
(Name and address):

**TO CONTRACTOR:**  
(Name and address):

**PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:**

The Work performed under this Contract 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 above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

**Warranty**

**Date of Commencement**

\_\_\_\_\_  
**ARCHITECT**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE OF ISSUANCE**

A list of items to be completed or corrected is attached hereto. 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.

**Cost estimate of Work that is incomplete or defective: \$ 0.00**

The Contractor will complete or correct the Work on the list of items attached hereto within Zero ( 0 ) days from the above date of Substantial Completion.

\_\_\_\_\_  
**CONTRACTOR**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE**

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

\_\_\_\_\_  
**OWNER**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE**

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

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



# SUBSTITUTION REQUEST (After the Bidding Phase)

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
 \_\_\_\_\_  
 From: \_\_\_\_\_  
 To: \_\_\_\_\_ Date: \_\_\_\_\_  
 \_\_\_\_\_  
 A/E Project Number: \_\_\_\_\_  
 Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
 Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Trade Name: \_\_\_\_\_ Model No.: \_\_\_\_\_  
 Installer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_

History:  New product  2-5 years old  5-10 yrs old  More than 10 years old

Differences between proposed substitution and specified product: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: \_\_\_\_\_  
 \_\_\_\_\_

### Similar Installation:

Project: \_\_\_\_\_ Architect: \_\_\_\_\_  
 Address: \_\_\_\_\_ Owner: \_\_\_\_\_  
 \_\_\_\_\_ Date Installed: \_\_\_\_\_

Proposed substitution affects other parts of Work:  No  Yes; explain \_\_\_\_\_  
 \_\_\_\_\_

Savings to Owner for accepting substitution: \_\_\_\_\_ (\$ \_\_\_\_\_).

Proposed substitution changes Contract Time:  No  Yes [Add] [Deduct] \_\_\_\_\_ days.

Supporting Data Attached:  Drawings  Product Data  Samples  Tests  Reports  \_\_\_\_\_

**SUBSTITUTION  
REQUEST  
(Continued)**

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: \_\_\_\_\_

Signed by: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

Attachments: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**A/E's REVIEW AND ACTION**

- Substitution approved - Make submittals in accordance with Specification Section 01330.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

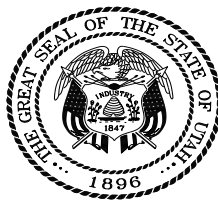
Signed by:

Date:

Additional Comments:     Contractor     Subcontractor     Supplier     Manufacturer     A/E     \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**ASBESTOS (LIMITED), AND LEAD (LIMITED) AND HAZARDOUS MATERIALS  
INSPECTION, SURVEY AND ASSESSMENT  
FOR THE  
OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
200 NORTH WASHINGTON BOULEVARD  
OGDEN, UTAH 84404**



State of Utah—Department of Administrative Services

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**DIVISION OF FACILITIES CONSTRUCTION  
AND MANAGEMENT**

4110 State Office Building/Salt Lake City, Utah 84114/538-3018

**A LIMITED ASBESTOS SURVEY AND ASSESSMENT  
FOR THE  
OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
200 NORTH WASHINGTON BOULEVARD  
OGDEN, UTAH 84404**

**December 28, 2021**

**Prepared for:**



State of Utah—Department of Administrative Services

**DIVISION OF FACILITIES CONSTRUCTION  
AND MANAGEMENT**

4110 State Office Building/Salt Lake City, Utah 84114/538-3018

**Mr. Jon Vance  
Project Manager  
State of Utah  
Department of Administrative Services  
Division of Facilities Construction and Management (DFCM)  
State Office Building Room 4110  
Salt Lake City, Utah 84114  
PH: (801) 686-4422**

**Prepared by:**



**R & R Environmental, Inc. (R & R)  
47 West 9000 South, Suite #2  
Sandy, Utah 84070  
dave@rrenviro.com  
Phone (801) 541-1035**



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## 1.0 INTRODUCTION

R & R Environmental, Inc. (R & R) was contacted to conduct a limited asbestos survey for Ogden-Weber Technical College Construction Technology Building (Roof, Exterior, Hall, Bathrooms, and Rooms 101, 102, 103, 104, 107, 108, 108E, 109, 111, 112, 112A, 114, 115, 115A, 115B, 116). The building is set to undergo a fire alarm system renovation. The survey consisted of a visual assessment of portions of the building for suspect asbestos containing materials (ACM) and bulk sampling of the materials. The fieldwork component of this survey was conducted by Mr. Jamison Moss who is a Utah Accredited Asbestos Building Inspector.

This report presents the conditions and observations noted on the visit dates.

The following general information is included in this survey report:

- Executive Summary (Section 2.0)
- Sampling Methods (Section 3.0)
- Analytical Results (Section 4.0)
- Conclusions (5.0)

## **2.0 EXECUTIVE SUMMARY**

No asbestos-containing material (ACM) was identified at inspected portions of the Ogden-Weber Technical College Construction Technology Building.

**OGDEN-WEBER TECHNICAL COLLEGE**  
**CONSTRUCTION TECHNOLOGY BUILDING**  
**DATE OF SURVEY: SEPTEMBER 2021**  
**NESHAP - REGULATED**  
**ASBESTOS-CONTAINING MATERIALS (R-ACM)**

1. Friable asbestos material (>1% asbestos and can be crumbled, pulverized or reduced to powder by hand pressure)
  - Thermal system insulation (TSI)\*
  - Textured ceiling material (TCM)\*
  - Spray-on insulation or fireproofing\*
  - Blown-in insulation\*
  - Ceiling tiles/panels\*
  - Plaster, gypsum board, gypsum board joint compound\*
  - Cloth materials\*
  - Paper materials\* (HVAC Paper Tape and Insulating Board)
  - Electrical wiring insulation\*
  - Sink undercoating (loose)\*
  - Other\*(fire door insulation)
  
2. Category I ACM which has become friable
  - Packings
  - Gaskets
  - Resilient floor coverings (floor tile and sheet vinyl)
  - Asphalt roofing products
  
3. Category I ACM that will be or has been subjected to sanding, grinding, cutting or abrading
  - Packings
  - Gaskets
  - Resilient floor coverings (floor tile and wall sheet vinyl)
  - Asphalt roofing products
  
4. Category II ACM that has a high probability of becoming or has become friable in the course of demolition or renovation operations
  - Asbestos cement materials (transite)\*
  - Asphalt, tar and rubber-base ACM products other than roofing products\*
  - Non-asphalt and non-paper roofing products\*
  - Paint\*
  - Fire brick and/or mortar\*
  - Stainless steel sink undercoating (solid)\*
  - Encapsulated TCM\*
  - Encapsulated TSI\*
  - Mastic for floor tile, ceiling tile, cove molding, etc.\*
  - Other

**OGDEN-WEBER TECHNICAL COLLEGE**  
**CONSTRUCTION TECHNOLOGY BUILDING**  
**DATE OF SURVEY: SEPTEMBER 2021**  
**NESHAP NON-REGULATED**  
**ASBESTOS-CONTAINING MATERIAL (N-R-ACM)**

1.  $\geq 1\%$  asbestos
  
2. Category I Non-friable (cannot be crumbled, pulverized, or reduced to powder by hand pressure) ACM with  $>1\%$  asbestos by new PLM procedure  
 Packings  
 Gaskets  
 Resilient floor coverings (floor tile)  
 Asphalt roofing products
  
3. Category II Non-friable ACM with  $>1\%$  asbestos by new PLM procedure (Category includes items meeting Category I definition but not specifically listed in that category)  
 Asbestos cement materials (transite)\* (window panels)  
 Asphalt, tar and rubber-base ACM products other than roofing products\* (caulking and sealants)  
 Non-asphalt and non-paper roofing products\*  
 Paint\*  
 Fire brick and/or mortar\*  
 Sink undercoating (solid)\*  
 Mastic for floor tile, ceiling tile, cove molding, etc.\*  
 Other\*

Notes:

1. (\*) denotes R & R's interpretation of materials included in this category.
2. New PLM procedure is outlined in Appendix A, Subpart F, 40 CFR, Part 783, Section 1, Polarized Light Microscopy.
3. The Environmental Protection Agency (EPA) National Emission Standard for Hazardous Air Pollutants (NESHAP) asbestos revision as outlined in 40 CFR, Part 61, became effective November 20, 1990. The asbestos classification system outlined in the revision and included in this section is dynamic in nature. Asbestos materials classified as "NON-REGULATED" at the time of the survey may become "REGULATED" due to ongoing or planned maintenance, renovation, or demolition actions, which can transform a material containing greater than 1% asbestos from a "non-friable" and NON-REGULATED to a friable and REGULATED condition. Classification of ACM in this section and in the executive summary of this report is, therefore, based on the observations of the surveyor at the time of the survey and may or may not be appropriate at later dates.
4. Maintenance, renovation, demolition, weathering, normal wear, water or other damage can alter the "NON-REGULATED" status of materials, and necessitate precautions required for handling them as "REGULATED" asbestos-materials.



### **3.0 SAMPLING METHODS**

Survey procedures were based on those outlined in Title 40 Code of Federal Regulation (CFR) Part 763, USEPA Asbestos Hazard Emergency Response Act, and the Asbestos Model Accreditation Plan (effective April 4, 1994). The procedures included visual observation, physical inspection, bulk sample collection, and condition assessment of suspect ACM. The number of samples collected was based on the amount and accessibility of each homogeneous material, with consideration given for the type, age, and condition.

Fifty – nine (59) samples were collected from the suspect materials to assess the presence of asbestos (or lack thereof) in building materials/systems. Each sample collected was placed into a sealable plastic bag or tub, marked with a unique sample identification code, and packaged for subsequent shipment to the laboratory for analysis. Individual sample identification consisted of a numeric code denoting the sampling media/location.

Subsequent to packaging and labeling, samples were submitted under proper chain-of-custody to Reservoirs Environmental, Inc., Denver, Colorado. The National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896 accredits Reservoirs for asbestos analysis. Samples were analyzed via Polarized Light Microscopy (PLM) utilizing EPA Method 600/M4-82-020. Please note that USEPA and OSHA regulations define an ACM as a material containing more than one (1) percent asbestos, by volume, as determined by PLM analysis. In the case of multi-layer systems (e.g., floor tile/mastic layers), the laboratory analyzed and reported each layer separately.

### **4.0 SURVEY RESULTS**

Fifty – nine (59) representative samples collected were submitted for analytical determination. A summary of analytical results for samples collected and analyzed for this survey are in Appendix B (Laboratory Results) and are discussed below by building material/system type. Photographs illustrating representative asbestos containing media are included as Appendix C.

## **5.0 CONCLUSIONS**

No ACM was identified during the survey of the facility (See the Executive Summary for specific materials/locations).

## **6.0 LIMITATIONS AND EXCLUSION OF WARRANTY**

This asbestos survey and assessment was performed using procedures and a level of diligence typically exercised by professional consultants performing similar services. However, asbestos-containing material (ACM) can be present in a structure, but not identified using ordinary investigative procedures.

No asbestos survey can completely, eliminate uncertainty regarding the presence of ACM. R & R Environmental, Inc.'s level of diligence and investigative procedures are intended to reduce, but not eliminate, potential uncertainty regarding the presence of ACM. The procedures used for this survey attempt to establish a balance between the competing goals of limiting investigative costs, time, and building damage, and reducing the uncertainty about unknown conditions. Therefore, the determinations in this report should not be construed as a guarantee that all ACM present in the subject property has been included in this report.

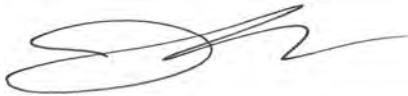
This report presents R & R Environmental, Inc.'s professional determinations, which are dependent upon information obtained during performance of consulting services. R & R Environmental, Inc. assumes no responsibility for omissions or errors resulting from inaccurate information provided by sources outside of R & R Environmental, Inc.

No warranty or guarantee, expressed or implied, is made regarding the findings, conclusions, or recommendations contained in this report. The limitations presented above supersede the requirements or provisions of all other contracts or scopes of work, implied, or otherwise, except stated or acknowledged herein.

**A LIMITED ASBESTOS SURVEY AND ASSESSMENT  
OF THE  
OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
OGDEN, UTAH 84404**

During the month of September 2021, R & R Environmental, Inc. (R & R) of Sandy, Utah, conducted a limited asbestos survey and assessment for Ogden-Weber Technical College. Bulk samples of suspect asbestos-containing materials were collected and analyzed. The condition of all friable and non-friable asbestos-containing materials were assessed.

The following accredited and certified inspectors performed the inspection, collected the samples and made assessment:



\_\_\_\_\_  
Jamison Moss  
State of Utah, Division of Air Quality Inspector  
Certification Number: ASB-6674  
State of Utah Company Certification: ASBC-237

\_\_\_\_\_  
December 28, 2021

Date

This report was reviewed by:



\_\_\_\_\_  
David C. Roskelley, MSPH, CIH, CSP  
State of Utah, Division of Air Quality Inspector  
Certification Number: ASB-1370  
AHERA Inspector #5 PSI 65451 I  
Certified Safety Professional #15774  
Certified Industrial Hygienist #8529  
State of Utah Company Certification ASBC-237

\_\_\_\_\_  
December 28, 2021

Date

**Appendix A**  
**Sample Log**

## SAMPLE LOG

Sample #	Material / Homogenous Area	Sample Location	Quantity	Lab Result (%/Type)	Photo #	Assumed ACM (Yes/No)	Assessment
CS-01	CMU Block Filler / S01	Room 108E	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-02	CMU Block Filler / S01	Room 104	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-03	CMU Block Filler / S01	Room 108	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-04	CMU Block Filler / S01	Hall	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-05	CMU Block Filler / S01	Hall	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-06	Wall System / S02	Room 108	1,125 ft <sup>2</sup>	None Detected	-	No	Good
CS-07	Wall System / S02	Hall	1,125 ft <sup>2</sup>	None Detected	-	No	Good
CS-08	Wall System / S02	Room 115C	1,125 ft <sup>2</sup>	None Detected	-	No	Good
CS-09	2'x2' Ceiling Panel / M01	Hall	483 ft <sup>2</sup>	None Detected	-	No	Good
CS-10	2'x2' Ceiling Panel / M01	Hall	483 ft <sup>2</sup>	None Detected	-	No	Good
CS-11	Brick and Mortar / M02	Exterior	16 ft <sup>2</sup>	None Detected	-	No	Good
CS-12	Brick and Mortar / M02	Exterior	16 ft <sup>2</sup>	None Detected	-	No	Good
CS-13	Roofing Materials / S03	Roof	~2,500 ft <sup>2</sup>	None Detected	-	No	Good
CS-14	Roofing Materials / S03	Roof	~2,500 ft <sup>2</sup>	None Detected	-	No	Good
CS-15	Roofing Materials / S03	Roof	~2,500 ft <sup>2</sup>	None Detected	-	No	Good
CS-16	Roofing Materials / S03	Roof	~2,500 ft <sup>2</sup>	None Detected	-	No	Good
CS-17	Roofing Materials / S03	Roof	~2,500 ft <sup>2</sup>	None Detected	-	No	Good
CS-18	Black Vibration Isolator / M03	Room 112	1 ft <sup>2</sup>	None Detected	-	No	Good
CS-19	Black Vibration Isolator / M03	Room 112	1 ft <sup>2</sup>	None Detected	-	No	Good
CS-20	AHU Sealant / M04	Room 112	222 ft <sup>2</sup>	None Detected	-	No	Good
CS-21	AHU Sealant / M04	Room 112	222 ft <sup>2</sup>	None Detected	-	No	Good
CS-22	TSI-Lagging / T01	Room 112	537 lf	None Detected	-	No	Good
CS-23	TSI-Lagging / T01	Room 112	537 lf	None Detected	-	No	Good
CS-24	TSI-Lagging / T01	Room 112	537 lf	None Detected	-	No	Good
CS-25	TSI-End Sealant / T02	Room 112	8 ft <sup>2</sup>	None Detected	-	No	Good
CS-26	TSI-End Sealant / T02	Room 112	8 ft <sup>2</sup>	None Detected	-	No	Good
CS-27	TSI-End Sealant / T02	Room 112	8 ft <sup>2</sup>	None Detected	-	No	Good
CS-28	Pipe Thread Sealant / M05	Room 112	19 ft <sup>2</sup>	None Detected	-	No	Good
CS-29	Pipe Thread Sealant / M05	Freezer Area	19 ft <sup>2</sup>	None Detected	-	No	Good
CS-30	CMU Block Filler / S01	Room 112	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-31	CMU Block Filler / S01	Room 115	6,751 ft <sup>2</sup>	None Detected	-	No	Good
CS-32	Wall System / S02	Room 115 Classroom	1,125 ft <sup>2</sup>	None Detected	-	No	Good
CS-33	Wall System / S02	Room 115	1,125 ft <sup>2</sup>	None Detected	-	No	Good



Sample #	Material / Homogenous Area	Sample Location	Quantity	Lab Result (%/Type)	Photo #	Assumed ACM (Yes/No)	Assessment
CS-34	Overhead Door Caulk / M06	Room 112	68 ft <sup>2</sup>	None Detected	-	No	Good
CS-35	Overhead Door Caulk / M06	Room 115	68 ft <sup>2</sup>	None Detected	-	No	Good
CS-36	Drinking Fountain Putty / M07	Room 112	2 ft <sup>2</sup>	None Detected	-	No	Good
CS-37	Drinking Fountain Putty / M07	Room 112	2 ft <sup>2</sup>	None Detected	-	No	Good
CS-38	Green Duct Sealant / M08	Room 108	48 ft <sup>2</sup>	None Detected	-	No	Good
CS-39	Green Duct Sealant / M08	Room 108	48 ft <sup>2</sup>	None Detected	-	No	Good
CS-40	Gray Duct Sealant / M09	Room 108	24 ft <sup>2</sup>	None Detected	-	No	Good
CS-41	Gray Duct Sealant / M09	Room 108	24 ft <sup>2</sup>	None Detected	-	No	Good
CS-42	Gray Vinyl Cove Base & Mastic / M10	Room 115C	188 ft <sup>2</sup>	None Detected	-	No	Good
CS-43	Gray Vinyl Cove Base & Mastic / M10	Room 115 Office	188 ft <sup>2</sup>	None Detected	-	No	Good
CS-44	2'x4' Ceiling Panel #1 / M11	Room 115 Classroom	88 ft <sup>2</sup>	None Detected	-	No	Good
CS-45	2'x4' Ceiling Panel #1 / M11	Room 115 Classroom	88 ft <sup>2</sup>	None Detected	-	No	Good
CS-46	2'x4' Ceiling Panel #2 / M12	Room 115 Classroom	21 ft <sup>2</sup>	None Detected	-	No	Good
CS-47	2'x4' Ceiling Panel #2 / M12	Room 115 Classroom	21 ft <sup>2</sup>	None Detected	-	No	Good
CS-48	Black Vinyl Cove Base & Mastic / M13	Room 115 Classroom	82 ft <sup>2</sup>	None Detected	-	No	Good
CS-49	Black Vinyl Cove Base & Mastic / M13	Room 115 Classroom	82 ft <sup>2</sup>	None Detected	-	No	Good
CS-50	Window Caulk / M14	Room 115 Classroom	90 ft <sup>2</sup>	None Detected	-	No	Good
CS-51	Window Caulk / M14	Room 115 Classroom	90 ft <sup>2</sup>	None Detected	-	No	Good
CS-52	Gray Freezer Caulk / M15	Freezer Area	155 ft <sup>2</sup>	None Detected	-	No	Good
CS-53	Gray Freezer Caulk / M15	Freezer Area	155 ft <sup>2</sup>	None Detected	-	No	Good
CS-54	Yellow Freezer Caulk / M16	Freezer Area	1 ft <sup>2</sup>	None Detected	-	No	Good
CS-55	Yellow Freezer Caulk / M16	Freezer Area	1 ft <sup>2</sup>	None Detected	-	No	Good
CS-56	Gray Flooring Compound / M17	115 Classroom	375 ft <sup>2</sup>	None Detected	-	No	Good
CS-57	Gray Flooring Compound / M17	115 Classroom	375 ft <sup>2</sup>	None Detected	-	No	Good
CS-58	Black Freezer Sealant / M18	Freezer Area	2 ft <sup>2</sup>	None Detected	-	No	Good
CS-59	Black Freezer Sealant / M18	Freezer Area	2 ft <sup>2</sup>	None Detected	-	No	Good

**Appendix B**  
**Laboratory Report**



September 25, 2021

**Subcontractor Number:**

**Laboratory Report:** RES 506166-1

**Project #/P.O. #:** None Given

**Project Description:** OWATC-Construction Tech

Jamison Moss  
R & R Environmental  
47 West 9000 South #2  
Sandy UT 84070

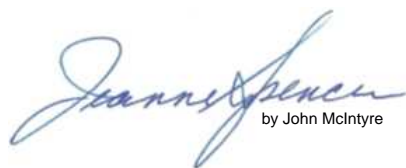
Dear Jamison,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA LAP, LLC), Lab ID 101533 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

**RES 506166-1** is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed, as received by the customer. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,



by John McIntyre

Jeanne Spencer  
President



## RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

**TABLE: I ANALYSIS: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME**

RES Job Number: **RES 506166-1**  
 Client: **R & R Environmental**  
 Client Project/P.O.: **None Given**  
 Client Project Description: **OWATC-Construction Tech**  
 Date Samples Received: **September 22, 2021**  
 Analysis Type: **EPA 600/R-93/116 - Short Report, Bulk**  
 Turnaround: **Priority**  
 Date Samples Analyzed: **September 25, 2021**

NA = Not Analyzed
NR = Not Received
ND = None Detected
TR = Trace; <1 % Visual Estimate
Trem-Act = Tremolite-Actinolite

Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non- Asbestos Fibrous Components (%)	Non- Fibrous Components (%)
				Mineral	Visual Estimate (%)		
506166 - Ct-01	A	Gray paint w/ gray granular material	100		ND	0	100
506166 - Ct-02	A	Gray granular material w/ gray paint	100		ND	0	100
506166 - Ct-03	A	Gray paint w/ gray granular material	100		ND	0	100
506166 - Ct-04	A	Gray granular material w/ gray paint	100		ND	0	100
506166 - Ct-05	A	Gray granular material w/ gray paint	100		ND	0	100
506166 - Ct-06	A	Off white tape	5		ND	95	5
	B	Off white joint compound	7		ND	0	100
	C	Off white texture w/ gray paint	9		ND	0	100
	D	Tan/off white drywall	79		ND	20	80
506166 - Ct-07	A	Off white compound	2		ND	0	100
	B	Off white joint compound	4		ND	0	100
	C	Beige tape	6		ND	95	5
	D	Tan/off white drywall	88		ND	25	75

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

# RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

**TABLE: I ANALYSIS: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME**

RES Job Number: **RES 506166-1**  
 Client: **R & R Environmental**  
 Client Project/P.O.: **None Given**  
 Client Project Description: **OWATC-Construction Tech**  
 Date Samples Received: **September 22, 2021**  
 Analysis Type: **EPA 600/R-93/116 - Short Report, Bulk**  
 Turnaround: **Priority**  
 Date Samples Analyzed: **September 25, 2021**

NA = Not Analyzed
NR = Not Received
ND = None Detected
TR = Trace; <1 % Visual Estimate
Trem-Act = Tremolite-Actinolite

Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non- Asbestos Fibrous Components (%)	Non- Fibrous Components (%)
				Mineral	Visual Estimate (%)		
506166 - Ct-08	A	Off white tape	8		ND	95	5
	B	Off white compound w/ off white paint	12		ND	0	100
	C	Off white joint compound	15		ND	0	100
	D	Tan/off white drywall	65		ND	35	65
506166 - Ct-09	A	Black/beige ceiling tile	100		ND	70	30
506166 - Ct-10	A	Black/beige ceiling tile	100		ND	70	30
506166 - Ct-11	A	Off white mortar	35		ND	0	100
	B	Tan brick	65		ND	0	100
506166 - Ct-12	A	Off white mortar	8		ND	0	100
	B	Tan brick	92		ND	0	100

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

  
 John C. McIntyre  
 Analyst





RES Job #: 506166

SUBMITTED BY		INVOICE TO		CONTACT INFORMATION		SERIES	
Company: <b>R &amp; R Environmental</b>		Company: <b>R &amp; R Environmental</b>		Contact: <b>Jamison Moss</b>		<b>-1 PLM Priority</b>	
Address: <b>47 West 9000 South #2</b>		Address: <b>47 West 9000 South #2</b>		Phone: <b>(801) 928-1560</b>			
<b>Sandy, UT 84070</b>		<b>Sandy, UT 84070</b>		Fax:			
Project Number and/or P.O. #: <b>None Given</b>				Cell:			
Project Description/Location: <b>OWATC-Construction Tech</b>				Final Data Deliverable Email Address:			
				<b>jamison@rrenviro.com (+ 3 ADDNL. CONTACTS)</b>			

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm				REQUESTED ANALYSIS				VALID MATRIX CODES				LAB NOTES				
PLM / PCM / TEM	DTL	RUSH	PRIORITY	STANDARD	PLM - PLM Short Report (EPA/600/R-93/116) TEM - AHERA (+/- or Quantified), Microvacc (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Drinking Water, Waste Water, Bulk +/-, CARB Modified Ahera PCM - 7400A, 7400B, OSHA DUST - Total, Respirable METALS - Analyte(s) Lead Only (7082, 7420, Waste Water, Foodware), Multi Metals (7303, 6020A, 200.8, Waste Water, Foodware, OSHA ID-125G), pH (Liquid or Non-Liquid), TCLP, RCRA 8 Scan, Welding Fume Scan, Full Metals Scan ORGANICS - Methamphetamine, TSS VIABLES - Campylobacter, Bacillus, Salmonella (Culturable or 1-2), Listeria, E.coli O157:H7, E.coli/Coliforms - Plated, S.aureus, Yeast & Mol, Aerobic Plate Count, Coliforms/E.coli - (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbial Count (w/ID or w/ID), Enterococcus (+/- or Quantification), Legionella (P, NP, C) MEDICAL - Biberburden, LAL MOLD - Spore Trap, Bulk Mold, Particulate Identification	Air = A	Bulk = B	Dust = D	Food = F	Paint = P	Soil = S	Surface = SU	Swab = SW	Tape = T	Wipe = W	Drinking Water = DW Waste Water = WW **ASTM E1792 approved wipe media only**
CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm																
Dust	RUSH	PRIORITY	STANDARD													
Metals	RUSH	PRIORITY	STANDARD	*PRIOR NOTICE REQUIRED FOR SAME DAY TAT												
Organics*	SAME DAY	RUSH	PRIORITY	STANDARD												
MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm																
Viable Analysis**	PRIORITY	STANDARD		**TAT DEPENDENT ON SPEED OF MICROBIAL GROWTH												
Medical Device Analysis	RUSH	STANDARD														
Mold Analysis	RUSH	PRIORITY	STANDARD													
**Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.**																
Special Instructions:																
Client Sample ID Number (Sample ID's must be unique)				ASBESTOS	CHEMISTRY	MICROBIOLOGY	Sample Volume (L) / Area	Length (or Aliquots) x Width (or Area per Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	Laboratory Analysis Instructions			
1	Ct-01	X							B							
2	Ct-02	X							B							
3	Ct-03	X							B							
4	Ct-04	X							B							
5	Ct-05	X							B							
6	Ct-06	X							B							
7	Ct-07	X							B							
8	Ct-08	X							B							
9	Ct-09	X							B							
10	Ct-10	X							B							
11	Ct-11	X							B							
12	Ct-12	X							B							

REI will analyze incoming samples based on information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing, client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days. Failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By:		<b>Jamison Moss</b>	Date/Time: <b>09/21/2021 7:48:50</b>	Sample Condition: <b>Acceptable</b>
Received By:		<b>Jessica Shapiro</b>	Date/Time: <b>09/22/2021 7:14:07</b>	Carrier: <b>Fed-Ex</b>



September 29, 2021

**Subcontractor Number:**

**Laboratory Report:** RES 506580-1

**Project #/P.O. #:** None Given

**Project Description:** OTECH construction tech #2

Jamison Moss  
R & R Environmental  
47 West 9000 South #2  
Sandy UT 84070

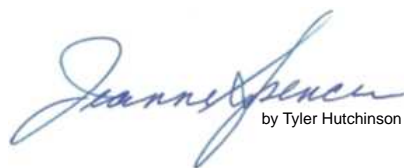
Dear Jamison,

Reservoirs Environmental, Inc. is an analytical laboratory accredited for the analysis of Industrial Hygiene and Environmental matrices by the National Voluntary Laboratory Accreditation Program (NVLAP), Lab Code 101896-0 for Transmission Electron Microscopy (TEM) and Polarized Light Microscopy (PLM) analysis and the American Industrial Hygiene Association (AIHA LAP, LLC), Lab ID 101533 for Phase Contrast Microscopy (PCM) analysis. This laboratory is currently proficient in both Proficiency Testing and PAT programs respectively.

Reservoirs Environmental, Inc. has analyzed the following samples for asbestos content as per your request. The analysis has been completed in general accordance with the appropriate methodology as stated in the attached analysis table. The results have been submitted to your office.

**RES 506580-1** is the job number assigned to this study. This report is considered highly confidential and the sole property of the customer. Reservoirs Environmental, Inc. will not discuss any part of this study with personnel other than those of the client. The results described in this report only apply to the samples analyzed, as received by the customer. This report must not be used to claim endorsement of products or analytical results by NVLAP or any agency of the U.S. Government. This report shall not be reproduced except in full, without written approval from Reservoirs Environmental, Inc. Samples will be disposed of after sixty days unless longer storage is requested. If you have any questions about this report, please feel free to call 303-964-1986.

Sincerely,



by Tyler Hutchinson

Jeanne Spencer  
President



## RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

**TABLE: I ANALYSIS: PLM BULK ANALYSIS, PERCENTAGE COMPOSITION BY VOLUME**

RES Job Number: **RES 506580-1**  
 Client: **R & R Environmental**  
 Client Project/P.O.: **None Given**  
 Client Project Description: **OTECH construction tech #2**  
 Date Samples Received: **September 27, 2021**  
 Analysis Type: **EPA 600/R-93/116 - Short Report, Bulk**  
 Turnaround: **Priority**  
 Date Samples Analyzed: **September 29, 2021**

NA = Not Analyzed  
 NR = Not Received  
 ND = None Detected  
 TR = Trace; <1 % Visual Estimate  
 Trem-Act = Tremolite-Actinolite

Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non-Asbestos Fibrous Components  (%)	Non-Fibrous Components  (%)
				Mineral	Visual Estimate  (%)		
506580 - Ct-13	A	Tan insulation	30		ND	65	35
	B	Black tar w/ tan granular material	30		ND	0	100
	C	Black tar w/ black fibrous tar	40		ND	10	90
506580 - Ct-14	A	Black fibrous tar w/ black tar	40		ND	25	75
	B	Tan insulation	60		ND	80	20
506580 - Ct-15	A	Black fibrous tar	10		ND	20	80
	B	Black tar	10		ND	0	100
	C	Brown fibrous material	80		ND	90	10
506580 - Ct-16	A	Yellow foam	10		ND	0	100
	B	Brown fibrous perlitic material	15		ND	75	25
	C	Black tar	35		ND	0	100
	D	Black multi-layered fibrous tar	40		ND	20	80
506580 - Ct-17	A	Yellow foam	15		ND	0	100
	B	Brown fibrous perlitic material	15		ND	75	25
	C	Black tar w/ brown rock fragments	25		ND	0	100
	D	Black fibrous tar	45		ND	20	80

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

## RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

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 ND = None Detected  
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 Trem-Act = Tremolite-Actinolite

Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non-Asbestos Fibrous Components  (%)	Non-Fibrous Components  (%)
				Mineral	Visual Estimate  (%)		
506580 - Ct-18	A	Black/white fibrous resinous material	100		ND	15	85
506580 - Ct-19	A	Black/white fibrous resinous material	100		ND	15	85
506580 - Ct-20	A	Gray caulk	30		ND	0	100
	B	White paint	70		ND	0	100
506580 - Ct-21	A	White paint	40		ND	0	100
	B	Gray caulk	60		ND	0	100
506580 - Ct-22	A	Tan/silver wrap	20		ND	65	35
	B	White paint	30		ND	0	100
	C	Yellow insulation	50		ND	95	5
506580 - Ct-23	A	White/silver wrap	20		ND	65	35
	B	Yellow insulation	80		ND	95	5
506580 - Ct-24	A	Tan/silver wrap	20		ND	65	35
	B	Yellow insulation	80		ND	95	5
506580 - Ct-25	A	White paint	10		ND	0	100
	B	White sealant	20		ND	0	100
	C	Yellow insulation	70		ND	95	5

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

## RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

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Laboratory Sample ID	L	A	Y	E	R	Physical Description	Sub Part	Asbestos Content		Non-Asbestos Fibrous Components (%)	Non-Fibrous Components (%)
								Mineral	Visual Estimate (%)		
Client Sample Number							(%)		(%)		(%)
506580 - Ct-26	A					White/silver wrap	10		ND	65	35
	B					White sealant	25		ND	0	100
	C					Yellow insulation	65		ND	95	5
506580 - Ct-27	A					White sealant	25		ND	0	100
	B					Yellow insulation	75		ND	95	5
506580 - Ct-28	A					Tan/multi-colored debris	100		ND	15	85
506580 - Ct-29	A					Tan/multi-colored debris	100		ND	25	75
506580 - Ct-30	A					Beige granular material w/ gray paint	100		ND	0	100
506580 - Ct-31	A					Beige granular material w/ gray paint	100		ND	0	100
506580 - Ct-32	A					White tape	3		ND	90	10
	B					White joint compound	15		ND	0	100
	C					White compound w/ white paint	15		ND	0	100
	D					Gray/tan drywall	67		ND	10	90

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

## RESERVOIRS ENVIRONMENTAL, INC

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Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non-Asbestos Fibrous Components  (%)	Non-Fibrous Components  (%)
				Mineral	Visual Estimate  (%)		
506580 - Ct-33	A	White tape	3		ND	90	10
	B	White joint compound	20		ND	0	100
	C	White compound w/ white paint	20		ND	0	100
	D	White/tan drywall	57		ND	10	90
506580 - Ct-34	A	Gray caulk w/ gray paint	100		ND	0	100
506580 - Ct-35	A	Tan caulk w/ tan/gray paint	100		ND	0	100
506580 - Ct-36	A	Tan caulk	100		ND	0	100
506580 - Ct-37	A	Tan caulk	100		ND	0	100
506580 - Ct-38	A	Gray caulk	100		ND	0	100
506580 - Ct-39	A	Gray caulk	100		ND	0	100
506580 - Ct-40	A	Gray caulk	100		ND	0	100
506580 - Ct-41	A	Gray caulk	100		ND	0	100
506580 - Ct-42	A	Tan adhesive	5		ND	0	100
	B	Gray cove base	95		ND	0	100

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.



## RESERVOIRS ENVIRONMENTAL, INC

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Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non-Asbestos Fibrous Components  (%)	Non-Fibrous Components  (%)
				Mineral	Visual Estimate  (%)		
506580 - Ct-43	A	Tan adhesive	5		ND	0	100
	B	Gray cove base	95		ND	0	100
506580 - Ct-44	A	Gray/white ceiling tile	100		ND	65	35
506580 - Ct-45	A	Gray/white ceiling tile	100		ND	65	35
506580 - Ct-46	A	White/tan drywall ceiling tile	100		ND	10	90
506580 - Ct-47	A	White/tan drywall ceiling tile	100		ND	15	85
506580 - Ct-48	A	Tan adhesive	5		ND	0	100
	B	Black cove base	95		ND	0	100
506580 - Ct-49	A	Tan adhesive	6		ND	0	100
	B	Black cove base	94		ND	0	100
506580 - Ct-50	A	Gray caulk	100		ND	0	100
506580 - Ct-51	A	Gray caulk	100		ND	0	100
506580 - Ct-52	A	Gray caulk	100		ND	0	100
506580 - Ct-53	A	Gray caulk	100		ND	0	100
506580 - Ct-54	A	Yellow resinous material	100		ND	0	100

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

# RESERVOIRS ENVIRONMENTAL, INC

NVLAP Lab Code 101896-0  
AIHA LAP, LLC. LAB ID 101533

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 Turnaround: **Priority**  
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---

Laboratory Sample ID  Client Sample Number	L A Y E R	Physical Description	Sub Part  (%)	Asbestos Content		Non- Asbestos Fibrous Components (%)	Non- Fibrous Components (%)
				Mineral	Visual Estimate (%)		
506580 - Ct-55	A	Yellow resinous material	100		ND	0	100
506580 - Ct-56	A	Gray granular material w/ colorless adhesive	100		ND	0	100
506580 - Ct-57	A	Gray caulk w/ colorless adhesive	100		ND	0	100
506580 - Ct-58	A	Gray caulk	100		ND	5	95
506580 - Ct-59	A	Gray caulk	100		ND	5	95

\* TEM Analysis recommended for organically bound material (i.e. floor tile) if PLM results are <1%.

  
Tyler Hutchinson  
Analyst

  
Landon Spells  
Analyst



RES Job #: 506580

SUBMITTED BY	INVOICE TO	CONTACT INFORMATION	SERIES
Company: <b>R &amp; R Environmental</b>	Company: <b>R &amp; R Environmental</b>	Contact: <b>Jamison Moss</b>	<b>-1 PLM Priority</b>
Address: <b>47 West 9000 South #2</b>	Address: <b>47 West 9000 South #2</b>	Phone: <b>(801) 928-1560</b>	
<b>Sandy, UT 84070</b>	<b>Sandy, UT 84070</b>	Fax:	
Project Number and/or P.O. #: <b>None Given</b>		Cell:	
Project Description/Location: <b>OTECH construction tech #2</b>		Final Data Deliverable Email Address: <b>jamison@rrenviro.com (+ 3 ADDNL. CONTACTS)</b>	

ASBESTOS LABORATORY HOURS: Weekdays: 7am - 7pm & Sat. 8am - 5pm				REQUESTED ANALYSIS				VALID MATRIX CODES				LAB NOTES
<b>PLM</b> / PCM / TEM	DTL	RUSH	<b>PRIORITY</b> STANDARD	<b>PLM - PLM Short Report (EPA600/R-93116)</b> TEM - AHERA (+/- or Quantified), Microvacc (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Drinking Water, Waste Water, Bulk +/-, CARB Modified Ahera PCM - 7400A, 7400B, OSHA DUST - Total, Respirable METALS - Analyte(s) Lead Only (7082, 7420, Waste Water, Foodware), Multi Metals (7303, 6020A, 200.8, Waste Water, Foodware, OSHA ID-125G), pH (Liquid or Non-Liquid), TCLP, RCRA 8 Scan, Welding Fume Scan, Full Metals Scan ORGANICS - Methamphetamine, TSS VIABLES - Campylobacter, Bacillus, Salmonella (Culturable or 1-2), Listeria, E.coli O157:H7, E.coli/Colliforms - Plated, S.aureus, Yeast & Mol, Aerobic Plate Count, Coliforms/E.coli - (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbial Count (w/ID or w/ID, +/-, Enterococcus (+/- or Quantification), Legionella (P, NP, C) MEDICAL - Bieburden, LAL MOLD - Spore Trap, Bulk Mold, Particulate Identification	Air = A	Bulk = B	Air = A Bulk = B Dust = D Food = F Paint = P Soil = S Surface = SU Swab = SW Tape = T Wipe = W Drinking Water = DW Waste Water = WW **ASTM E1792 approved wipe media only**	Sample Volume (L) / Area Length (or Aliquots) x Width (or Area per Aliquot) Matrix Code # of Containers Date Collected mm/dd/yy Time Collected hh:mm	<b>Laboratory Analysis Instructions</b>			
<b>CHEMISTRY LABORATORY HOURS: Weekdays: 8am - 5pm</b>												
Dust	RUSH	PRIORITY	STANDARD									
Metals	RUSH	PRIORITY	STANDARD		*PRIOR NOTICE REQUIRED FOR SAME DAY TAT							
Organics*	SAME DAY	RUSH	PRIORITY STANDARD									
<b>MICROBIOLOGY LABORATORY HOURS: Weekdays: 8am - 5pm</b>												
Viable Analysis**	PRIORITY	STANDARD			**TAT DEPENDENT ON SPEED OF MICROBIAL GROWTH							
Medical Device Analysis	RUSH	STANDARD										
Mold Analysis	RUSH	PRIORITY	STANDARD									
**Turnaround times establish a laboratory priority, subject to laboratory volume and are not guaranteed. Additional fees apply for afterhours, weekends and holidays.**												
<b>Special Instructions:</b>												
<b>Client Sample ID Number</b> (Sample ID's must be unique)				<b>ASBESTOS</b>	<b>CHEMISTRY</b>	<b>MICROBIOLOGY</b>						
1	Ct-13			X					B			
2	Ct-14			X					B			
3	Ct-15			X					B			
4	Ct-16			X					B			
5	Ct-17			X					B			
6	Ct-18			X					B			
7	Ct-19			X					B			
8	Ct-20			X					B			
9	Ct-21			X					B			
10	Ct-22			X					B			
11	Ct-23			X					B			
12	Ct-24			X					B			
13	Ct-25			X					B			

REI will analyze incoming samples based on information received and will not be responsible for errors or omissions in calculations resulting from the inaccuracy of original data. By signing, client/company representative agrees that submission of the following samples for requested analysis as indicated on this Chain of Custody shall constitute an analytical services agreement with payment terms of NET 30 days. Failure to comply with payment terms may result in a 1.5% monthly interest surcharge.

Relinquished By:	<b>Jamison Moss</b>	Date/Time: <b>09/24/2021 12:31:37</b>	Sample Condition: <b>Acceptable</b>
Received By:	<b>Jessica Shapiro</b>	Date/Time: <b>09/27/2021 10:11:08</b>	Carrier: <b>Fed-Ex</b>



Res Job#: 506580

Submitted By: R & R Environmental

Client Sample ID Number <small>(Sample ID's must be unique)</small>	REQUESTED ANALYSIS			VALID MATRIX CODES						LAB NOTES				
	ASBESTOS	CHEMISTRY	MICROBIOLOGY	Air = A	Bulk = B	Dust = D	Food = F	Paint = P	Soil = S	Surface = SU	Swab = SW	Tape = T	Wipe = W	Laboratory Analysis Instructions
14 Ct-26	X				B									
15 Ct-27	X				B									
16 Ct-28	X				B									
17 Ct-29	X				B									
18 Ct-30	X				B									
19 Ct-31	X				B									
20 Ct-32	X				B									
21 Ct-33	X				B									
22 Ct-34	X				B									
23 Ct-35	X				B									
24 Ct-36	X				B									
25 Ct-37	X				B									
26 Ct-38	X				B									
27 Ct-39	X				B									
28 Ct-40	X				B									
29 Ct-41	X				B									
30 Ct-42	X				B									
31 Ct-43	X				B									
32 Ct-44	X				B									
33 Ct-45	X				B									
34 Ct-46	X				B									
35 Ct-47	X				B									
36 Ct-48	X				B									
37 Ct-49	X				B									
38 Ct-50	X				B									
39 Ct-51	X				B									
40 Ct-52	X				B									
41 Ct-53	X				B									
42 Ct-54	X				B									
43 Ct-55	X				B									



Res Job#: 506580

Submitted By: R & R Environmental

Client Sample ID Number (Sample ID's must be unique)	REQUESTED ANALYSIS			VALID MATRIX CODES						LAB NOTES		
	ASBESTOS	CHEMISTRY	MICROBIOLOGY	Air = A	Bulk = B	Dust = D	Food = F	Paint = P	Soil = S	Surface = SU	Swab = SW	Laboratory Analysis Instructions
44 Ct-56	X											
45 Ct-57	X											
46 Ct-58	X											
47 Ct-59	X											

PLM - PLM Short Report (EPA/600/R-93/116)	TEM - AHERA (+/- or Quantified), Microvac (+/- or Quantified), Wipe (+/- or Quantified), NIOSH 7402, Yamate Level II, ISO 10312, ISO 13794, Chatfield, Drinking Water, Waste Water, Bulk +/-, CARB Modified Ahera	PCM - 7400A, 7400B, OSHA	DUST - Total, Respirable	METALS - Analyte(s) Lead Only (7062, 7420, Waste Water, Foodware), Multi-Metals (7303, 6020A, 200.8, Waste Water, Foodware, OSHA ID-125G), pH (Liquid or Non-Liquid), TCLP, RCRA 8 Scan, Welding Fume Scan, Full Metals Scan	ORGANICS - Methamphetamine, TSS	VIABLES - Campylobacter, Bacillus, Salmonella (Culturable or 1-2), Listeria, E.coli O157:H7, E.coli/Coliforms - Plated, S.aureus, Yeast & Mol, Aerobic Plate Count, Coliforms/E.coli - (State Water, Drinking Water, Non-Drinking Water, +/-, Quantification), Lactic Acid, Viable Microbial Count (w/ID or w/ID), Enterococcus (+/- or Quantification), Legionella (P, NP, C)	MEDICAL - Bioburden, LAL	MOLD - Spore Trap, Bulk Mold, Particulate Identification
Sample Volume (L) / Area	Length (or Aliquots) x Width (or Area per Aliquot)	Matrix Code	# of Containers	Date Collected mm/dd/yy	Time Collected hh:mm	**ASTM E1792 approved wipe media only**		

# **Appendix C**

## **Photo Log**





**PHOTO 1**

**R & R Environmental, Inc.**

47 West 9000 South, Suite #2, Sandy, Utah 84070  
 (801) 352-2380 • Fax: (801) 352-2381

PROJECT NO:

DESIGNED BY:

SCALE:

REVIEWED BY:

DRAWN BY:

DATE:

FILE:

**SITE PHOTOGRAPHS**

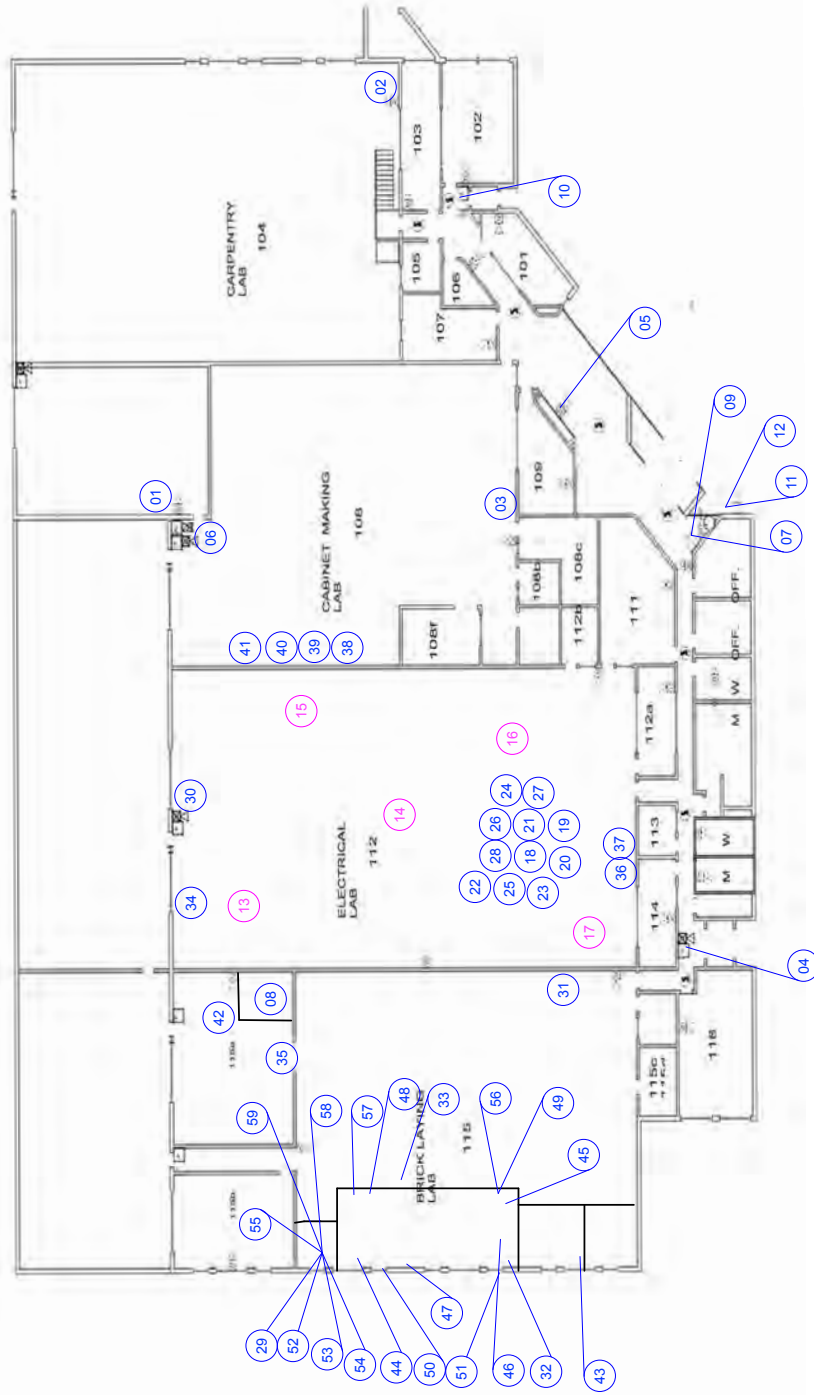
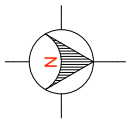
**AN ASBESTOS SURVEY AND ASSESSMENT**

**OGDEN-WEBER TECHNICAL COLLEGE**

**CONSTRUCTION TECHNOLOGY BUILDING**

**OGDEN, UTAH**

**Appendix D**  
**Floor Plan**



##) = SAMPLE NUMBER AND LOCATION

##) = ROOF SAMPLE NUMBER AND LOCATION

OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
OGDEN, UTAH

SEPTEMBER 2021

# MAIN FLOOR

## ASBESTOS FLOOR PLAN



**Appendix D**  
**State of Utah Certifications**



State of Utah

SPENCER J. COX  
Governor

DEIDRE HENDERSON  
Lieutenant Governor

Department of  
Environmental Quality

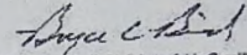
Kimberly D. Shelley  
Executive Director

DIVISION OF AIR QUALITY  
Bryce C. Bird  
Director

Utah Asbestos Certification



Jamison Moss  
ASB-6674  
Inspector (Exp. 01/03/2022)

  
Director, Utah Division of Air Quality

March 16, 2021

DAQA-001-21

Jamison Moss  
R&R Environmental, Inc.  
47 West 9000 South, #2  
Sandy, UT 84070

Dear Mr. Moss:

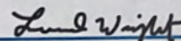
Re: Utah Asbestos Program Individual Certification Card

The Utah Division of Air Quality (DAQ) has reviewed your Utah Asbestos Program Certification Application for Individuals and we are pleased to inform you that your application has been approved. Your new asbestos program individual certification card is enclosed with this letter and this card is the sole method of individual certification documentation that you will receive from the DAQ. Please note that if a physical card is not attached, it will be forthcoming. Please keep this letter as proof of current certification.

Please check the information on your asbestos program certification card carefully. Please confirm that the photograph, name, and certification discipline(s) are correct. Also, please remember to keep your current asbestos program certification card with you at all times when you are performing regulated asbestos work activities.

Please contact Tamie Call at (385) 227-1055 or at [twcall@utah.gov](mailto:twcall@utah.gov) if you have any questions regarding this letter or the enclosed asbestos program certification card.

Sincerely,

  
Leonard Wright (Mar 12, 2021 11:32 MST)

Leonard Wright, Manager  
Air Toxics, Lead-Based Paint, and Asbestos Section

LW:TC:lr





State of Utah

GARY R. HERBERT  
Governor

SPENCER J. COX  
Lieutenant Governor

Department of  
Environmental Quality

Alan Matheson  
Executive Director

DIVISION OF AIR QUALITY  
Bryce C. Bird  
Director

Utah Department of Environmental Quality  
Division of Air Quality

The Utah Division of Air Quality certifies that:

**R & R Environmental, Inc.**

is hereby certified as an asbestos company in  
accordance with the provisions of Utah Administrative  
Code R307-801

Certification number: ASBC-237

Expiration date: 12/31/23 *[Signature]*

Director, Utah Division of Air Quality

September 26, 2018

DAQA-003-18

David Roskelley  
R&R Environmental, Inc.  
47 West 9000 South, #2  
Sandy, UT 84070

Dear Mr. Roskelley:

Re: Utah Asbestos Company Certification Card

The Utah Division of Air Quality (DAQ) has received your Certification Application for Asbestos Company and we are pleased to inform you that your application has been approved. Your new Asbestos company certification card is enclosed with this letter and this card is the sole method of Asbestos company certification documentation that you will receive from the DAQ. Please check the information on your asbestos company certification card carefully and please confirm that the company name and certification expiration date are correct.

Please be aware that your company is certified to perform asbestos projects in accordance with applicable state and federal rules and the use of Utah certified individuals is mandatory. Also, your certification may be revoked or suspended if the Utah certified individual or company are found to be in violation of the asbestos certification and work practices standards found in Utah Administrative Code R307-801 or the National Emission Standard for Asbestos found in Title 40 Code of Federal Regulations Part 61 Subpart M.

Please contact Tamie Call at (801) 536-4007 or at [twcall@utah.gov](mailto:twcall@utah.gov) if you have any questions about this letter or the enclosed asbestos company certification card.

Sincerely,

Robert W. Ford, Manager  
Air Toxics, Lead-Based Paint, and Asbestos Section

RWF:TC:lr



State of Utah

GARY R. HERBERT  
Governor

SPENCER J. COX  
Lieutenant Governor

Department of  
Environmental Quality

L. Scott Baird  
Executive Director

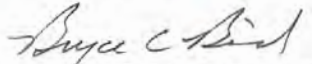
DIVISION OF AIR QUALITY  
Bryce C. Bird  
Director

Utah Asbestos Certification



David C. Roskelley  
ASB-1370

Inspector (Exp. 08/26/2021)  
Management Planner (Exp. 08/26/2021)  
Supervisor (Exp. 04/30/2021)  
Project Designer (Exp. 07/15/2021)

  
Director, Utah Division of Air Quality

September 8, 2020

DAQA-001-20

David Roskelley  
R&R Environmental, Inc.  
47 West 9000 South, #2  
Sandy, UT 84070

Dear Mr. Roskelley:

Re: Utah Asbestos Program Individual Certification Card

The Utah Division of Air Quality (DAQ) has reviewed your Utah Asbestos Program Certification Application for Individuals and we are pleased to inform you that your application has been approved. Your new asbestos program individual certification card is enclosed with this letter and this card is the sole method of individual certification documentation that you will receive from the DAQ.

Please check the information on your asbestos program certification card carefully. Please confirm that the photograph, name, and certification discipline(s) are correct. Also, please remember to keep your current asbestos program certification card with you at all times when you are performing regulated asbestos work activities.

Please contact Tamie Call at (801) 536-4007 or at [twcall@utah.gov](mailto:twcall@utah.gov) if you have any questions regarding this letter or the enclosed asbestos program certification card.

Sincerely,

Leonard Wright, Manager  
Air Toxics, Lead-Based Paint, and Asbestos Section

LW:TC:lr



# ABIH<sup>®</sup>

american board of industrial hygiene<sup>®</sup>

organized to improve the practice of industrial hygiene  
proclaims that

*David C. Roskelley*

having met all requirements of  
education, experience and examination, and  
ongoing maintenance,  
is hereby certified in the

**COMPREHENSIVE PRACTICE  
of  
INDUSTRIAL HYGIENE**

and has the right to use the designations

**CERTIFIED INDUSTRIAL HYGIENIST**

**CIH**

Certificate Number	8529 CP
Awarded:	July 3, 2003
Expiration Date:	December 1, 2023



*Jeffrey Miller*  
Chair, ABIH

*Alma P. Quinn*  
Chief Executive Officer, ABIH

**LIMITED LEAD-BASED PAINT INSPECTION  
FOR THE  
OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
200 WASHINGTON BOULEVARD  
OGDEN, UTAH 84404**

**December 28, 2021**

**Prepared for:**



State of Utah—Department of Administrative Services  
DIVISION OF FACILITIES CONSTRUCTION  
AND MANAGEMENT  
4110 State Office Building/Salt Lake City, Utah 84114/538-3018

**Mr. Jon Vance  
Project Manager  
State of Utah  
Department of Administrative Services  
Division of Facilities Construction and Management (DFCM)  
State Office Building Room 4110  
Salt Lake City, Utah 84114  
PH: (801) 686-4422**

**Prepared by:**



**R & R Environmental, Inc. (R & R)  
47 West 9000 South, Suite #2  
Sandy, Utah 84070  
dave@rrenviro.com  
Phone (801) 541-1035**

# LIMITED LEAD-BASED PAINT INSPECTION

## OGDEN-WEBER TECHNICAL COLLEGE CONSTRUCTION TECHNOLOGY BUILDING

### TABLE OF CONTENTS

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6.0 Results and Recommendation .....	5
8.0 Limitations and Exclusion of Warranty.....	5

#### **Appendices**

- A. Data Tables
  - Table 1 – Building Component with Lead Levels at 0.3 mg/cm<sup>2</sup> and above
  - Table 2 – Building Component with Lead Levels at below 0.3 mg/cm<sup>2</sup>
- B. Photograph Log

# Limited Lead-Based Paint Inspection

## STATE OF UTAH OGDEN-WEBER TECHNICAL COLLEGE CONSTRUCTION TECHNOLOGY BUILDING

### 1.0 INTRODUCTION

During September 2021, a limited lead-based paint (LBP) survey was conducted for the Ogden-Weber Technical College Construction Technology Building. The purpose of the survey was to identify lead in paint on interior and exterior surfaces of the building. Measurements for lead in paint were made using a Niton XLP 300 X-ray Fluorescence (XRF) Spectrum Analyzer. No chip sampling or laboratory analysis was performed for confirmation of XRF measurements.

The survey work was overseen by David Roskelley with R & R Environmental, Inc. in Sandy, Utah. David Roskelley has completed Lead Inspector Training through the University of Utah, Rocky Mountain Center for Occupational and Environmental Health (RMCOEH), an EPA-sponsored Regional Lead Training Center, and is certified by the State of Utah, Division of Environmental Quality, as a Lead Inspector.

The U.S. Department of housing and Urban Development (HUD) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in housing* (HUD Guidelines), Chapter 7: Lead-Based Paint Inspection, 1997 Revision, was generally followed for this survey, with modifications appropriate for a non-residential building.

The following accredited and certified inspector oversaw the inspection, collected the samples and made assessment:



---

David C. Roskelley, MSPH, CIH, CSP  
Lead-Based Paint Inspector  
Certification Number: PB-1041

---

December 28, 2021

Date

This report was reviewed by:



---

David C. Roskelley, MSPH, CIH, CSP  
Lead-Based Paint Inspector  
Certification Number: PB-1041

---

December 28, 2021

Date

## 2.0 BUILDING DESCRIPTION

### Building Identification

Building Name..... OTECH-Construction Technology Building  
Building Address .....200 Washington Boulevard, Ogden, UT 84404

### Building Construction

Building Construction Date ..... NA  
Building Type ..... Educational  
Building Total Sq. Ft ..... ~ 40,000 ft<sup>2</sup> (Affected Area)  
Structural System..... Structural Steel  
Exterior Wall Construction..... Brick, Stone  
Floor Deck Construction ..... Reinforced concrete  
Roof Construction..... Tar, Gravel  
Floors Above Grade..... 1  
Floors Below Grade..... 0

### Interior Finishes

Floors ..... Concrete, Vinyl Flooring, Tile, Carpet  
Walls ..... Tile, Block, Wallboard System, Corrugated Steel  
Attic ..... NA  
Crawl space..... NA

### Building Mechanical

Heating Plant ..... Central Air  
Main Heating Distribution..... Central Air  
Cooling Plant ..... Central Air  
Main A / C Distribution..... Central Air

### 3.0 LEAD-BASED PAINT DEFINITIONS

HUD defines “lead-based paint” as any coating that has a lead concentration of 1.0 milligram of lead per square centimeter (1.0 mg/cm<sup>2</sup>) or greater, or if the lead concentration is greater than 0.5% by weight. The Consumer Product Safety Commission (CPSC) currently considers paint to be lead-containing if the concentration of lead exceeds 600 ppm (0.06% by weight). In 1978, the CPSC banned the sale of lead-based paint to consumers, and banned its application in areas where consumers have direct access to painted surfaces. Both the CPSC and HUD definitions of lead-containing paint are aimed at protecting the general population from exposure to lead in the residential setting.

By contrast, the mission of the Occupational Safety and Health Administration (OSHA) with respect to lead-containing paint, is to protect workers during construction activities that may generate elevated airborne lead concentrations. OSHA states that construction work (including renovation, maintenance, and demolition) carried-out on structures coated with paint have lead concentrations lower than the HUD or CPSC can still result in airborne lead concentrations in excess of regulatory limits. For this reason, OSHA has not defined lead-containing paint, but states that paint having any measurable level of lead may pose a substantial exposure hazard during construction work, depending upon the work performed.

### 4.0 PROCEDURES

#### 4.1 Paint Sampling Methodologies

Direct measurements of lead in paint were made using a Niton 300 XLp Series X-ray Fluorescence (XRF) Spectrum Analyzer. The Niton 300 XLp Lead Paint Analyzer non-destructively measures lead concentrations of painted surfaces, regardless of the number of layers present. These instruments were developed specifically for addressing lead-based paint issues in housing and their use in identifying potential exposure hazards for renovation or construction work must be augmented by selective collection and analysis of physical paint chip samples.

The newer XRF instruments are capable of identifying lead in paint at concentrations of about 0.3 milligram per square centimeter (mg/cm<sup>2</sup>) or greater. When lead concentrations are lower than this, the instruments are not capable of making accurate, reliable measurements, and the reported lead concentration may underestimate or overestimate the actual lead concentration in the paint. Therefore, an XRF readings of 0.4 mg/cm<sup>2</sup> or greater may be considered lead-containing from an OSHA perspective, and any readings of 0.3 mg/cm<sup>2</sup> or less should be confirmed by the collection and laboratory analysis of paint chip samples, or assumed to be positive for lead.

Where paint chip samples are necessary, samples are collected according to the protocol specified in the HUD Guidelines. The samples are then submitted to a laboratory recognized under the EPA’s National Lead Laboratory Accreditation Program (NLLAP) for analysis by flame atomic absorption spectrophotometry according to American Society of Testing and Materials (ASTM) method ASTM E 1645.

## 4.2 XRF Calibration

Before beginning the testing and after the testing was completed, the internal calibration of the LPA-1 was checked by taking two consecutive measurements on a National Institute for Standards and Technology (NIST) standard with a known concentration of lead. Three more readings were taken on a lead-free wood block. These calibration checks are reported within the XRF data tables found in Appendix A of this report and are maintained in a file at R & R Environmental, Inc. to detect changes in instrument performance over time.

## 4.3 Lead Paint Inspection Data Tables

The XRF instrument generates a unique set of data tables for each inspection and can be exported into Microsoft Excel Spreadsheet format .xls. The Sequential Report lists the measurements made throughout the property in sequential order, from the first measurement to the last. The Data table is maintained in a file at R & R Environmental, Inc.

## 5.0 FINDINGS

The XRF instrument indicated that lead is not present on interior or exterior surfaces. These surfaces are listed in Table 1 “positive” building components (Measurements of 0.3 mg/cm<sup>2</sup> and above) in Appendix A of this report:

If lead was detected in some of the building’s painted surfaces, the OSHA Lead in Construction Standard (29 CFR 1926.62) will apply to any construction work (including renovation and demolition) that may disturb those surfaces. The standard requires, among other things, the following:

- Initial training on the hazards of lead exposure, proper work practices, respiratory protection, and other topics;
- An initial exposure assessment, by air monitoring, to determine the lead exposure assessment, until sample analysis indicates exposures below the Permissible Exposure Limit;
- Hand washing facilities, designated clean change areas, and designated eating areas.

In addition to the above considerations, the presence of lead in demolition debris has the potential to impose limitations on where and how the debris may be disposed. The Resource Conservation and Recovery Act (RCRA), Subtitles C and D, require that the waste must be analyzed to determine the amount of leachable lead present. The type of test to be performed on the waste is the Toxicity Characteristic Leaching Procedure (TCLP) for lead, and the results of this test will determine whether the material must be handled and disposed of as hazardous waste. For structures containing large amounts of lead-containing paint, significant potential for failing the TCLP exists.



## **6.0 RESULTS AND RECOMMENDATIONS**

Lead-based paint was not found during this limited survey.

## **7.0 LIMITATIONS AND EXCLUSIONS OF WARRANTY**

This limited lead inspection was performed using procedures and a level of diligence typically exercised by professional consultants performing similar services. However, lead-based paint (LBP) can be present in a surface, but not identified using ordinary investigative procedures.

No lead inspection can completely eliminate uncertainty regarding the presence of LBP. R & R Environmental, Inc. level of diligence and investigative procedures are intended to reduce, but not eliminate, potential uncertainty regarding the presence of LBP. The procedures used for this survey attempt to establish a balance between the competing goals of limiting investigative costs, time, and building damage, and reducing the uncertainty about unknown conditions. Therefore, the determinations in this report should not be construed as a guarantee that all LBP present in the subject property has been included in this report.

This report presents R & R Environmental, Inc.'s professional determinations, which are dependent upon information obtained during performance of consulting services. R & R Environmental, Inc. assumes no responsibility for omissions or errors resulting from inaccurate information provided by sources outside of R & R Environmental, Inc.

No warranty or guarantee, expressed or implied, is made regarding the findings, conclusions, or recommendations contained in this report. The limitations presented above supersede the requirements or provisions of all other contracts or scopes of work, implied or otherwise, except those stated or acknowledged herein.

## **Appendix A**

# **Lead Paint Inspection Data Tables**

# Table 1

## Building Components with Lead Levels at 0.3 mg/cm<sup>2</sup> and Above Ogden-Weber Technical College Construction Technology Building

Room	Floor (2)	Sample Number	Lead Level (mg/cm <sup>2</sup> )	Component	Side (1)	Substrate	Color	Condition
		137	0.9	CALIBRATE				
		1	1	CALIBRATE				
		2	1.1	CALIBRATE				
		3	1.1	CALIBRATE				
		136	1.1	CALIBRATE				
		138	1.1	CALIBRATE				

\*Side: A=North, B=East, C=South, D=West

**Table 2**

**Building Components with Lead Levels Below 0.3 mg/cm<sup>2</sup>  
Ogden-Weber Technical College  
Construction Technology Building**

Room	Floor (2)	Sample Number	Lead Level (mg/cm <sup>2</sup> )	Component	Side (1)	Substrate	Color	Condition
EXTERIOR	FIRST	4	0	WALL	A	BRICK	ORANGE	INTACT
EXTERIOR	FIRST	5	0	WALL	A	BRICK	ORANGE	INTACT
EXTERIOR	FIRST	6	0	WALL	A	BRICK	ORANGE	INTACT
112	FIRST	7	0	WALL	C	CONCRETE	GRAY	INTACT
112	FIRST	8	0	WALL	A	CONCRETE	GRAY	INTACT
112	FIRST	9	0	WALL	D	CONCRETE	GRAY	INTACT
112	FIRST	10	0	WALL	A	CONCRETE	WHITE	INTACT
112	FIRST	12	0	WALL	A	CONCRETE	YELLOW	INTACT
112	FIRST	13	0	WALL	A	CONCRETE	YELLOW	INTACT
112	FIRST	16	0	COLUMN	B	METAL	GRAY	INTACT
112	FIRST	23	0	POST	B	METAL	YELLOW	INTACT
112	FIRST	24	0	POST	D	METAL	YELLOW	INTACT
112	FIRST	25	0	PIPE	B	METAL	BLUE	INTACT
112	FIRST	26	0	PIPE	C	METAL	BLUE	INTACT
112	FIRST	27	0	CONDUIT	C	METAL	GRAY	INTACT
112	FIRST	28	0	CONDUIT	D	METAL	GRAY	INTACT
112	FIRST	29	0	AHU	CEILING	METAL	WHITE	INTACT
112	FIRST	30	0	AHU	CEILING	METAL	WHITE	INTACT
112	FIRST	31	0	AHU	CEILING	METAL	WHITE	INTACT
115C	FIRST	32	0	WALL	D	DRYWALL	WHITE	INTACT
115C	FIRST	33	0	WALL	D	DRYWALL	WHITE	INTACT
115C	FIRST	34	0	WALL	C	CONCRETE	GRAY	INTACT
115C	FIRST	35	0	WALL	D	CONCRETE	GRAY	INTACT
115C	FIRST	36	0	WALL	B	CONCRETE	WHITE	INTACT
115C	FIRST	37	0	WALL	A	CONCRETE	WHITE	INTACT
115C	FIRST	38	0	WALL	C	CONCRETE	WHITE	INTACT
115C	FIRST	39	0	DOOR	D	METAL	GRAY	INTACT
115C	FIRST	40	0	DOOR	A	METAL	GRAY	INTACT
115C	FIRST	41	0	DOOR FRAME	D	METAL	GRAY	INTACT
115C	FIRST	42	0	DOOR FRAME	A	METAL	GRAY	INTACT
115C	FIRST	43	0	DOOR	A	METAL	TAN	INTACT
115C	FIRST	44	0	DOOR FRAME	A	METAL	TAN	INTACT
115C	FIRST	45	0	PIPE	B	METAL	BLUE	INTACT
115C	FIRST	46	0	PIPE	A	METAL	BLUE	INTACT
115C	FIRST	47	0	CONDUIT	C	METAL	WHITE	INTACT
115C	FIRST	48	0	CONDUIT	FLOOR	METAL	YELLOW	INTACT
115C	FIRST	49	0	CONDUIT	FLOOR	METAL	YELLOW	INTACT
115C	FIRST	50	0	CONDUIT	D	METAL	GRAY	INTACT
115C	FIRST	51	0	CONDUIT	A	METAL	GRAY	INTACT
115	FIRST	52	0	COLUMN	B	METAL	BLUE	INTACT
115	FIRST	53	0	COLUMN	C	METAL	BLUE	INTACT
115	FIRST	54	0	COLUMN	D	METAL	WHITE	INTACT

Room	Floor (2)	Sample Number	Lead Level (mg/cm <sup>2</sup> )	Component	Side (1)	Substrate	Color	Condition
115	FIRST	55	0	WALL	C	CONCRETE	BLUE	INTACT
115	FIRST	56	0	WALL	D	CONCRETE	BLUE	INTACT
115	FIRST	57	0	WALL	B	DRYWALL	WHITE	INTACT
115	FIRST	58	0	WALL	A	DRYWALL	WHITE	INTACT
115	FIRST	59	0	DOOR	A	METAL	GRAY	INTACT
115	FIRST	60	0	DOOR FRAME	A	METAL	GRAY	INTACT
115	FIRST	61	0	WINDOW	B	METAL	GRAY	INTACT
115	FIRST	62	0	WINDOW	B	METAL	GRAY	INTACT
115	FIRST	63	0	WALL	A	CONCRETE	WHITE	INTACT
115	FIRST	64	0	WALL	A	CONCRETE	WHITE	INTACT
115	FIRST	65	0	PIPE	C	METAL	BLUE	INTACT
115	FIRST	66	0	CONDUIT	D	METAL	WHITE	INTACT
115	FIRST	67	0	CONDUIT	D	METAL	GRAY	INTACT
115	FIRST	68	0	CONDUIT	C	METAL	GRAY	INTACT
115	FIRST	69	0	WINDOW FRAME	D	METAL	SILVER	INTACT
115	FIRST	70	0	WINDOW FRAME	D	METAL	SILVER	INTACT
115B	FIRST	71	0	WALL	B	CONCRETE	GRAY	INTACT
115B	FIRST	72	0	WALL	B	CONCRETE	WHITE	INTACT
108E	FIRST	73	0	WALL	C	CONCRETE	GRAY	INTACT
108E	FIRST	74	0	WALL	B	CONCRETE	GRAY	INTACT
108E	FIRST	75	0	WALL	B	DRYWALL	WHITE	INTACT
108E	FIRST	76	0	WALL	B	DRYWALL	WHITE	INTACT
108	FIRST	77	0	WALL	C	CONCRETE	GRAY	INTACT
108	FIRST	78	0	WALL	C	CONCRETE	GRAY	INTACT
108	FIRST	79	0	WALL	A	CONCRETE	GRAY	INTACT
108	FIRST	80	0	WALL	A	CONCRETE	GRAY	INTACT
108	FIRST	81	0	WALL	C	DRYWALL	WHITE	INTACT
108	FIRST	82	0	WALL	C	DRYWALL	WHITE	INTACT
109	FIRST	83	0	WALL	C	DRYWALL	WHITE	INTACT
109	FIRST	84	0	WALL	A	DRYWALL	WHITE	INTACT
104	FIRST	85	0	WALL	A	CONCRETE	GRAY	INTACT
104	FIRST	86	0	WALL	A	CONCRETE	GRAY	INTACT
103	FIRST	87	0	WALL	B	DRYWALL	WHITE	INTACT
103	FIRST	88	0	WALL	B	DRYWALL	WHITE	INTACT
103	FIRST	89	0	WALL	B	DRYWALL	WHITE	INTACT
103	FIRST	90	0	PANEL	CEILING	PAPER	BLACK	INTACT
103	FIRST	91	0	PANEL	CEILING	PAPER	BLACK	INTACT
102	FIRST	92	0	WALL	B	DRYWALL	WHITE	INTACT
102	FIRST	93	0	WALL	B	DRYWALL	WHITE	INTACT
102	FIRST	94	0	PANEL	CEILING	PAPER	BLACK	INTACT
102	FIRST	95	0	PANEL	CEILING	PAPER	BLACK	INTACT
HALL	FIRST	96	0	WALL	D	DRYWALL	WHITE	INTACT
HALL	FIRST	97	0	PANEL	CEILING	PAPER	BLACK	INTACT
HALL	FIRST	98	0	PANEL	CEILING	PAPER	BLACK	INTACT
HALL	FIRST	99	0	PANEL	CEILING	PAPER	BLACK	INTACT
HALL	FIRST	100	0	WALL	A	DRYWALL	WHITE	INTACT
HALL	FIRST	101	0	WALL	C	DRYWALL	WHITE	INTACT
HALL	FIRST	102	0	WALL	A	DRYWALL	WHITE	INTACT
HALL	FIRST	103	0	WALL	C	DRYWALL	WHITE	INTACT
111	FIRST	104	0	WALL	A	DRYWALL	WHITE	INTACT
111	FIRST	105	0	WALL	A	DRYWALL	WHITE	INTACT

Room	Floor (2)	Sample Number	Lead Level (mg/cm <sup>2</sup> )	Component	Side (1)	Substrate	Color	Condition
111	FIRST	106	0	PANEL	CEILING	PAPER	BLACK	INTACT
111	FIRST	107	0	PANEL	CEILING	PAPER	BLACK	INTACT
101	FIRST	108	0	WALL	A	DRYWALL	DRYWALL	INTACT
101	FIRST	109	0	WALL	A	DRYWALL	DRYWALL	INTACT
112A	FIRST	110	0	WALL	A	DRYWALL	DRYWALL	INTACT
112A	FIRST	111	0	WALL	A	DRYWALL	WHITE	INTACT
112A	FIRST	112	0	PANEL	CEILING	PAPER	BLACK	INTACT
116	FIRST	113	0	WALL	C	DRYWALL	WHITE	INTACT
116	FIRST	114	0	WALL	C	DRYWALL	WHITE	INTACT
116	FIRST	115	0	WALL	C	DRYWALL	WHITE	INTACT
116	FIRST	116	0	PANEL	CEILING	PAPER	BLACK	INTACT
116	FIRST	117	0	PANEL	CEILING	PAPER	BLACK	INTACT
MEN BATHROOM	FIRST	118	0	WALL	C	DRYWALL	TAN	INTACT
MEN BATHROOM	FIRST	119	0	WALL	CEILING	DRYWALL	TAN	INTACT
MEN BATHROOM	FIRST	120	0	WALL	CEILING	DRYWALL	TAN	INTACT
MEN BATHROOM	FIRST	121	0	WALL	D	DRYWALL	TAN	INTACT
MEN BATHROOM	FIRST	122	0	WALL	CEILING	DRYWALL	TAN	INTACT
MEN BATHROOM	FIRST	123	0	WALL	CEILING	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	124	0	WALL	CEILING	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	125	0	WALL	CEILING	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	126	0	WALL	B	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	127	0	WALL	C	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	128	0	WALL	CEILING	DRYWALL	TAN	INTACT
WOMEN BATHROOM	FIRST	129	0	WALL	CEILING	DRYWALL	TAN	INTACT
114	FIRST	133	0	WALL	A	DRYWALL	WHITE	INTACT
114	FIRST	134	0	WALL	A	DRYWALL	WHITE	INTACT
114	FIRST	135	0	PANEL	CEILING	PAPER	BLACK	INTACT
112	FIRST	11	0.01	WALL	A	CONCRETE	WHITE	INTACT
112	FIRST	14	0.01	COLUMN	D	METAL	WHITE	INTACT
112	FIRST	17	0.01	COLUMN	D	METAL	GRAY	INTACT
107	FIRST	131	0.01	WALL	A	DRYWALL	TAN	INTACT
107	FIRST	132	0.01	WALL	A	DRYWALL	TAN	INTACT
112	FIRST	18	0.02	DOOR	D	METAL	BLUE	INTACT
112	FIRST	15	0.03	COLUMN	A	METAL	WHITE	INTACT
112	FIRST	19	0.03	DOOR	C	METAL	BLUE	INTACT
107	FIRST	130	0.03	WALL	A	DRYWALL	TAN	INTACT
112	FIRST	22	0.1	DOOR FRAME	C	METAL	BLUE	INTACT
112	FIRST	20	0.19	DOOR FRAME	A	METAL	BLUE	INTACT
112	FIRST	21	0.2	DOOR FRAME	D	METAL	BLUE	INTACT

Notes: A=North, B=East, C=South, D=West

## **Appendix B**

# **Photograph Log**





**PHOTO 1: Ogden-Weber Technical College  
Construction Technology Building**

**R & R Environmental, Inc.**  
 47 West 9000 South, Suite #2, Sandy, Utah 84070  
 (801) 352-2380 • Fax: (801) 352-2381

PROJECT NO:

DESIGNED BY:

SCALE:

REVIEWED BY:

DRAWN BY:

DATE:

FILE:

**SITE PHOTOGRAPHS**  
**A LIMITED LEAD BASED PAINT INSPECTION**  
**OF THE**  
**OGDEN-WEBER TECHNICAL COLLEGE**  
**CONSTRUCTION TECHNOLOGY BUILDING**  
**OGDEN, UTAH 84404**

**HAZARDOUS MATERIALS INSPECTION  
FOR THE  
OGDEN-WEBER TECHNICAL COLLEGE  
CONSTRUCTION TECHNOLOGY BUILDING  
200 WASHINGTON BOULEVARD  
OGDEN, UTAH 84404**

**December 28, 2021**

**Prepared for:**



State of Utah—Department of Administrative Services

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**DIVISION OF FACILITIES CONSTRUCTION  
AND MANAGEMENT**

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# Hazardous Materials Inspection

**Ogden-Weber Technical College  
Construction Technology Building  
Ogden, Utah 84404**

During September 2021, Jamison Moss of R & R Environmental, Inc., conducted a hazardous materials inspection of the Ogden-Weber Technical College Construction Technology Building located at 200 Washington Boulevard in Ogden, Utah. The purpose of this survey was to identify the existence, extent, and condition of hazardous materials. The inspection was conducted based on an agreement with Jon Vance with Utah DFCM.

Hazardous materials requiring proper removal and disposal were identified at the Ogden-Weber Technical College Construction Technology Building, Ogden, Utah as follows:

<b>Material</b>	<b>Location</b>	<b>Quantity</b>	<b>Unit Cost</b>
Lead Batteries	Hall	2 units	\$75.00 / unit
Bulb	Classroom/Offices	241 Bulbs	\$2.00 / unit
Ballast	Classroom/Offices	126 units	\$8.00 / unit
Fire Extinguishers	Classroom/Offices	5 units	\$75.00 / unit
AC Units	Freezer/Offices/ Classrooms	4 units	\$150.00 / unit
Drinking Fountain	Room 112	1 unit	\$200.00 / unit
Thermostat	Room 112	1 unit	\$75.00 / unit
Chemicals	Scattered Throughout	26 gal	NA

The State of Utah's DFCM policy requires the items above to be removed and disposed of at a facility approved to accept such waste prior to demolition. This may or may not be applied to the city of Ogden in Weber County, but R & R Environmental, Inc. recommends removal and proper disposal of these components prior to any demolition activities.

The cost estimate to remove and dispose of these hazardous materials is estimated at approximately **\$2,890.00**. This cost estimate does not include transportation, removal, design, or management fees associated with dismantling and packaging the materials.

011000 SUMMARY  
012500 SUBSTITUTION PROCEDURES  
012600 CONTRACT MODIFICATION PROCEDURES  
012900 PAYMENT PROCEDURES  
013100 PROJECT MANAGEMENT & COORDINATION  
013200 CONSTRUCTION PROGRESS DOCUMENTATION  
013233 PHOTOGRAPHIC DOCUMENTATION  
013300 SUBMITTAL PROCEDURES  
014000 QUALITY REQUIREMENTS  
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015000 TEMPORARY FACILITIES & CONTROLS  
016000 PRODUCT REQUIREMENTS  
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017419 CONSTRUCTION WASTE MANAGEMENT & DISPOSAL  
017700 CLOSEOUT PROCEDURES  
017823 OPERATION & MAINTENANCE DATA  
017839 PROJECT RECORD DOCUMENTS  
017900 DEMONSTRATION & TRAINING

# GENERAL REQUIREMENTS

division

# 1

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contracts.
4. County Engineering Performance Bond
5. Access to site.
6. Work restrictions.
7. Specification and drawing conventions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: **ELECTRICAL PROGRAM RELOCATION – OGDEN WEBER TECHNICAL COLLEGE**

1. Project Location: **Ogden Weber Technical College, Ogden, Utah**

B. Owner: **Ogden Weber Technical College**

1. Owner's Representative: **Josh Ulm.**

C. Architect: Sanders Associates Architects, 2668 Grant Ave., Ogden, Utah 84401

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. The Work includes the remodel of an existing building into a cosmetology classroom building. The proposed work includes, but not limited to: Site work and building interior remodel as defined in the construction documents.

B. Type of Contract.

1. Project will be constructed under a single prime contract.

1.4 WORK UNDER SEPARATE CONTRACTS

- A. General: General Contractor to coordinate all work of the separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts. Costs of the separate contract to be included with the costs and schedule of the Project.

1.5 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.6 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.
- C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 3. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.

END OF SECTION 011000



SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 MINOR CHANGES IN THE WORK

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

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. 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 costs of labor and supervision directly attributable to the change.
    - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

C. Proposal Request Form: Use DFCM form, "Proposal Requests," dated February 9, 2006.

#### 1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner Architect and Contractor.'
- B. Change Order Form: Use DFCM form 050807, "Change Order Signature Page."

#### 1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on DFCM form CCD1A, dated April 2002. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Application for Payment forms with Continuation Sheets and Submittals Schedule.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. DFCM and Architect's project number.
    - d. DFCM contract number.
    - e. Contractor's name and address.
    - f. Date of submittal.
  - 2. Submit draft of AIA Document G703 Continuation Sheets.
  - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
  - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  - 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site. If stored offsite, include evidence of insurance or bonded warehousing.
  - 6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Allowances (if required): Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

### 1.3 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: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use 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 by a method ensuring receipt within 24 hours. 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. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
  1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.

3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    - a. Submit final Application for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
  4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
  4. Schedule of unit prices.
  5. Submittals Schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. List of Contractor's principal consultants.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.
  12. Certificates of insurance and insurance policies.
  13. Performance and Payment Bonds.
  14. Data needed to acquire Owner's insurance.
  15. Initial settlement survey and damage report, if require.
- H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination.
  - 2. Project meetings.
- B. See Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 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.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
  - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. 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. Preparation of the Schedule of Values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.
  - 9. Project closeout activities.



1.3 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: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for RFIs.
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of Record Documents.
    - l. Use of the premises and existing building.
    - m. Work restrictions.
    - n. Owner's occupancy requirements.
    - o. Responsibility for temporary facilities and controls.
    - p. Construction waste management and recycling.
    - q. Parking availability.
    - r. Office, work, and storage areas.
    - s. Equipment deliveries and priorities.
    - t. First aid.
    - u. Security.
    - v. Progress cleaning.
    - w. Working hours.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and

- installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at intervals as directed by Owner. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
  - 1) Interface requirements.
  - 2) Sequence of operations.
  - 3) Status of submittals.
  - 4) Deliveries.
  - 5) Off-site fabrication.
  - 6) Access.
  - 7) Site utilization.
  - 8) Temporary facilities and controls.
  - 9) Work hours.
  - 10) Hazards and risks.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) RFIs.
  - 16) Status of proposal requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
3. Minutes: Architect will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

**SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's Construction Schedule.
  - 2. Submittals Schedule.
  - 3. Daily construction reports.
  - 4. Field condition reports.
- B. See Division 01 Section "Payment Procedures" for submitting the Schedule of Values.

**1.2 SUBMITTALS**

- A. Submittals Schedule: Submit three 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. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period. Submit prior or at the same time as the first Application for Payment.
- C. Daily Construction Reports: Submit one copy at weekly intervals.
- D. Field Condition Reports: Submit one copy at time of discovery of differing conditions.

**1.3 COORDINATION**

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- 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 from parties involved.
  - 2. Coordinate each construction activity in the network 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, resubmittal, 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. Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

**2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL**

- A. Time Frame: Extend schedule from date established for commencement of the Work or the Notice to Proceed to date of Substantial Completion.
- B. Activities: Treat each story or 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 the following 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 resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  - 3. 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.
- C. 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. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Use of premises restrictions.
    - e. Provisions for future construction.
    - f. Seasonal variations.
    - g. Environmental control.
  - 2. Work Stages: Indicate important stages of construction for each major portion of the Work.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

- E. 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 (CPM SCHEDULE)**

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's Construction Schedule using a computerized CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for commencement of the Work or the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  - 2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 3. Use "one workday" as the unit of time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing and commissioning.
    - j. Punch list and final completion.
    - k. Activities occurring following final completion.
  - 2. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  - 3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- D. Initial Issue of Schedule: Prepare initial network diagram from a list of straight "early start-total float" sort. Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Principal events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
  9. Average size of workforce.
  10. Dollar value of activity (coordinated with the schedule of values).
- E. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.

## 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.
  2. Equipment at Project site.
  3. Approximate count of personnel at Project Site.
  4. Material deliveries.
  5. High and low temperatures and general weather conditions.
  6. Accidents.
  7. Stoppages, delays, shortages, and losses.
  8. Orders and requests of authorities having jurisdiction.
  9. Services connected and disconnected.
  10. Equipment or system tests and startups.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit 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.



**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 Architect Owner, separate contractors, testing and inspecting agencies, 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 013200**

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.

1.2 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.
  - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
  - 2. Identification: Provide the following information with each image description in file metadata tag:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Date photograph was taken.
    - d. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.

- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in file name for each image.
  - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
  
- C. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take photographs to show all existing conditions adjacent to property before starting the Work.
  - 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  
- D. Additional Photographs: Additional photographs in addition to preconstruction photographs specified.
  - 1. In emergency situations, take additional photographs within 24 hours of request.
  - 2. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Immediate follow-up when on-site events result in construction damage or losses.
    - b. Substantial Completion of a major phase or component of the Work.

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### 1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

### 1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

### 1.3 ACTION SUBMITTALS

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

### 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals if the following procedure is met.
  - 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings only if the following is submitted and accepted by all parties.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

- b. Contractor, or Sub-Contractor shall execute a data licensing agreement in the form of the Agreement Form: Electronic Drawing Media Distribution, available from the Architect.
    - c. Architect's Agreement Form available by request to the Contractor or Sub-contractor. Release of digital data will be occur only if the form is accepted by all parties.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 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. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
- D. Physical Sample Submittals: Place a permanent label or title block on each submittal item for identification.
  1. Additional Samples: Unless additional samples are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  2. Transmittal for Physical Sample Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
    - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
      - 1) Project name.
      - 2) Date.
      - 3) Destination (To:).
      - 4) Source (From:).
      - 5) Name and address of Architect.
      - 6) Name of Contractor.
      - 7) Name of firm or entity that prepared submittal.
      - 8) Names of subcontractor, manufacturer, and supplier.
      - 9) Category and type of submittal.
      - 10) Submittal purpose and description.

- 11) Specification Section number and title.
  - 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
  - 13) Drawing number and detail references, as appropriate.
  - 14) Indication of full or partial submittal.
  - 15) Transmittal number.
  - 16) Submittal and transmittal distribution record.
  - 17) Remarks.
  - 18) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of firm or entity that prepared submittal.
    - g. Names of subcontractor, manufacturer, and supplier.
    - h. Category and type of submittal.
    - i. Submittal purpose and description.
    - j. Specification Section number and title.
    - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    - l. Drawing number and detail references, as appropriate.
    - m. Location(s) where product is to be installed, as appropriate.
    - n. Related physical samples submitted directly.
    - o. Indication of full or partial submittal.
    - p. Transmittal number.
    - q. Submittal and transmittal distribution record.
    - r. Other necessary identification.
    - s. Remarks.
  5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    - a. Project name.
    - b. Number and title of appropriate Specification Section.

- c. Manufacturer name.
- d. Product name.
  
- F. Options: Identify options requiring selection by Architect.
  
- G. Deviations: Identify deviations from the Contract Documents on submittals.
  
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
  
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
  
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## **PART 2 - PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

- A. General Submittal Procedure Requirements:
  - 1. Submit electronic submittals via email as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
    - a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
  
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.



- c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- 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. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. 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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. 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(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. 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, (or number as required in specific section), sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
    - 1) 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.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  1. Submit product schedule in the following format:
    - a. PDF electronic file.
- F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit 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. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 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 Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 DEFINITIONS

- A. 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.
- B. 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. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- D. 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.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. 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, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" 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.

### 1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

### 1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.5 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, and telephone number 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 inspecting.
  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 Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  5. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

- A. General: 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.
- 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, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.



- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's 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. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - d. When testing is complete, remove test specimens, assemblies; do not reuse products on Project.
  - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect three days in advance of dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

#### 1.7 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 inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- D. 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.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location 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 any duties of Contractor.
- F. Associated Services: Cooperate with agencies 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 inspecting. Assist agency in obtaining samples.
  4. Delivery of samples to testing agencies.
  5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  6. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- 1.8 SPECIAL TESTS AND INSPECTIONS
- A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and in Statement of Special Inspections indicated on the drawings, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect 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 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 and Commissioning Authority reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, 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 017300 "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 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

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

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

D. Abbreviations and Names: Abbreviations and acronyms are frequently used in the Specifications and other Contract Documents to represent the name of a trade association, standards developing organization, authorities having jurisdiction, or other entity in the context of referencing a standard or publication. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of these entities. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

### 1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov](http://www.gpo.gov).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  3. DSCC - Defense Supply Center Columbus; (See FS).
  4. FED-STD - Federal Standard; (See FS).
  5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

- 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

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, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.5 QUALITY ASSURANCE

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



- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## PART 2 - PRODUCTS

### 2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

### 2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: 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.
  - 1. Locate facilities to limit site disturbance as specified in Division 01 Section "Summary."
- 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: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  - 1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- 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 and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- F. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine and computer in each field office.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Architect's office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
  - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

- I. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access project electronic documents and maintain electronic communications.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
  - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. 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.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
  - 1. Provide temporary, directional signs for construction personnel and visitors.
  - 2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  - 3. Maintain and touchup signs so they are legible at all times.
- E. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- G. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
  - 1. Do not load elevators beyond their rated weight capacity.
  - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3. Do not load elevators more than their indicated weight capacity.

H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. 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.

C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

D. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations. Coordinate with Owner for extent of fence on property.

2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

H. 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. Prohibit smoking in construction and Campus areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - a. All welding operations are required to have a continuous DFCM Hot Works observer and Hot Works Permit. Refer to requirements in Division 5 Section "Metal Fabrications".
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect materials from water damage and keep porous and organic materials from coming into prolonged contact with concrete.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Discard or replace water-damaged and wet material.
  4. Discard, replace, or clean stored or installed material that begins to grow mold.
  5. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than

Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This 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; product substitutions; and comparable products.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
- C. See Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

- A. Products: Items purchased 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. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, 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 specific manufacturer's product is named and accompanied by the words "basis-of-design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request.

Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
- b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.4 QUALITY ASSURANCE

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

#### 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

- B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

- C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.



1.6 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: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  - 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that 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 not in conflict with requirements of the Contract Documents.
  - 4. Where products are accompanied by the term "as selected," Architect will make selection.
  - 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  - 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
- B. Product Selection Procedures:
  - 1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.

2. **Manufacturer/Source:** Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. **Products:** Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
4. **Manufacturers:** Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. **Available Products:** Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. **Available Manufacturers:** Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. **Basis-of-Design Product:** Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
8. **Visual Matching Specification:** Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
9. **Visual Selection Specification:** Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
  - a. **Standard Range:** Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - b. **Full Range:** Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 COMPARABLE PRODUCTS

- A. **Conditions:** Architect will consider Contractor's request for comparable product 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:
  1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Installation of the Work.
  - 3. Cutting and patching.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
  
- B. Related Requirements:
  - 1. Section 011000 "Summary" for limits on use of Project site.
  - 2. Section 017700 "Closeout Procedures" for final cleaning.
  - 3. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
  - 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
  - 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
  - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

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

**3.2 PREPARATION**

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

- B. **Field Measurements:** Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. **Space Requirements:** Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. **Review of Contract Documents and Field Conditions:** Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 INSTALLATION

- A. **General:** Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. **Tools and Equipment:** Do not use tools or equipment that produce harmful noise levels.
- G. **Templates:** Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. **Attachment:** Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. **Mounting Heights:** Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with

integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.4 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  - 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  - 6. Proceed with patching after construction operations requiring cutting are complete.
- F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above **80 deg F (27 deg C)**.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.



- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements"

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

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

END OF SECTION 017300

**SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

**1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition waste.
  - 2. Recycling nonhazardous demolition and construction waste.
  - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

**1.2 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- 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 QUALITY ASSURANCE**

- A. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

**1.4 WASTE MANAGEMENT PLAN**

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section.

PART 2 - PRODUCTS (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. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 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.
- C. 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, recycled, reused, donated, and sold.
  - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area on-site designated by Owner.
  - 5. Protect items from damage during transport and storage.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.

- B. Recycling Receivers and Processors: List below is provided for information only; available recycling receivers and processors include, but are not limited to, the following:
- C. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- D. 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 they are 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.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- B. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- D. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- E. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- F. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
  - 1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation
- G. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- H. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 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.

### 3.6 DISPOSAL OF WASTE

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

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

#### B. Burning: Do not burn waste materials.

#### C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

**SECTION 017700 - CLOSEOUT PROCEDURES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
  
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

**1.2 ACTION SUBMITTALS**

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

**1.3 CLOSEOUT SUBMITTALS**

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

**1.4 MAINTENANCE MATERIAL SUBMITTALS**

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 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] <Insert number> 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, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
  5. Submit test/adjust/balance 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 5 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 heat and other utilities.
  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, including touchup painting.
  10. Touch up 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. Reinspection: 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.

#### 1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: 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 pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.
- B. Inspection: Submit a written request for final inspection to determine acceptance. 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.7 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. Submit list of incomplete items in the following format:
    - a. PDF electronic file. Architect will return annotated copy.



**1.8 SUBMITTAL OF PROJECT WARRANTIES**

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

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

**PART 3 - EXECUTION**

**3.1 FINAL CLEANING**

- A. 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 neither planted nor 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. Replace chipped or broken glass and other damaged transparent 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, elevator 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 light fixtures, lamps, globes, and reflectors to function with full efficiency.
- p. 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 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

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

1.2 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return copies.
- C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

**PART 2 - PRODUCTS**

**2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS**

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.
- B. Organization: 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.
- C. 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.
- D. 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.
- E. 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.
- F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of 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.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
  - a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
  - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
  - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.2 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
  1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. 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.
- C. 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.
- D. 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.

## 2.3 OPERATION MANUALS

- A. 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 is 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.
- B. 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.
- C. 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.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUALS

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. 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 warranty and bond information, as described below.
- B. 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.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 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.



- D. 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.
- E. 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.
- F. 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.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- 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. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.
- E. 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 operation and maintenance manuals.

- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Requirements:
  - 1. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set of marked-up record prints.
  - 2. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set of marked-up record prints.
- B. Record Specifications: Submit one paper copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 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. Record data as soon as possible after obtaining it.
  - c. Record and check the markup before enclosing concealed installations.
2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  4. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
  2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  3. Refer instances of uncertainty to Architect for resolution.
  4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 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. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

**2.3 RECORD PRODUCT DATA**

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

**2.4 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 PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

**PART 3 - EXECUTION**

**3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples 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.

END OF SECTION 017839

024119 SELECTIVE STRUCTURE DEMOLITION

EXISTING CONDITIONS

division **2**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of building or structure.
- B. See Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.

1.4 QUALITY ASSURANCE

- A. Pre-demolition Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

#### PART 2 - PRODUCTS (Not Used)

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

A. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

B. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

E. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

##### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.



### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

### 3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 5. Dispose of demolished items and materials promptly.
- B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  - 3. Protect items from damage during transport and storage.
  - 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable,

protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

033543 POLISHED CONCRETE FINISHING

CONCRETE

division **3**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 033543 - POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes polished concrete finishing.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of product requiring color selection.

1.3 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For polished concrete finishing to include in maintenance manuals. Also include the following
  - 1. Manufacturer's instructions on maintenance renewal of applied treatments
  - 2. Protocols and product specifications for joint filling, crack repair and/or surface repair.

1.4 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of samples, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches (1200 by 1200 mm) minimum, to demonstrate the expected range of finish, color, and appearance variations.
  - 1. Locate panels as indicated or, if not indicated, as directed by Architect.
  - 2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Demolish and remove field sample panels when directed.
- B. Manufacturers Qualifications:
  - 1. Manufacturer has a minimum of 5 years' experience in manufacturing components similar to or exceeding requirements of project.
  - 2. Manufacturer must be able to provide technically trained field representative during construction and approving application method
- C. Installer Qualifications:
  - 1. Installer experienced in performing work of this section who has specialized in installation work similar to that required for this project. The following are approved installers. Any installer that is not on this list will be required to submit qualifications and written

manufacturers application approvals for review. Acceptance by manufacturer and architect will be required before bidding.

- a) CDC Restoration, 801-514-9218
- b) Floortex, 801-589-0899
- c) National Construction Specialties, 801-514-9218
- d) Russ Hall Flooring, 801-292-8355
- e) Western States, 801-550-5057
- f) Concrete Covers and Services, 801-616-7602

- 1. Installer trained and having current certification for Manufacture Concrete Polishing System must be able to provide technically trained field representative during construction and approving application method

## 1.5 REFERENCES

- A. ASTM International (ASTM):
  - 1. ASTM C309 – Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
  - 2. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
  - 3. ASTM C779 – Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
  - 4. ASTM C805 – Standard Test Method for Rebound Number of Hardened Concrete
  - 5. ASTM E 1155 – Standard Test Method for Determining Floor Flatness and Levelness Using the F number system
- B. RILEM Test Method 11.4 Standard Measurement of Reduction of Moisture Penetration Through Horizontal Concrete Surfaces

## 1.6 PERFORMANCE REQUIREMENTS

- A. Performance Requirements: Provide polished flooring that has been selected, manufactured and installed to achieve the following:
  - 1. Abrasion Resistance: ASTM C779, Up to 400% increase in abrasion resistance Manufacturer must be able to provide technically trained field representative during construction and approving application method
  - 2. Reflectivity: Increase of 35% as determined by gloss meter
  - 3. Waterproof Properties: RILEM Test Method 11.4, 70% or greater reduction in absorption
  - 4. Impact Strength: ASTM C805, Up to 21% increased impact strength
  - 5. Must meet or exceed ADA/OSHA suggested 0.5 standard value for the Static Co-efficient of Friction

## 1.7 DELIVERY, STORAGE & HANDLING

- A. Delivery: Deliver materials in manufacturer's original packaging with identification labels and seals intact
- B. Storage and Protection:

1. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer
2. Protect Concrete Slab
  - a. Protect from petroleum stains during construction
  - b. Diaper all hydraulic lifts and power equipment
  - c. No pipe cutting machinery will be used on interior floor slab
  - d. Steel will not be placed on interior floor slab to avoid rust staining
  - e. No acids or acidic detergents will come into contact with slab

## PART 2 - PRODUCTS

### 2.1 LIQUID FLOOR TREATMENTS (Drawing Designation 'PCF-1')

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

### 2.1 MANUFACTURERS

- A. Basis-of-Design: Subject to compliance with requirements, provide ADVANCED FLOOR PRODUCTS, RETROPLATE SYSTEMS, or comparable product by the following:
  1. Advanced Floor Products
  2. SASE Company
- B. MATERIALS: Ensure concrete finishing components and materials are from single source, from single manufacturer.
  1. Hardener, Sealer, Densifier:
    - a. Advanced Floor Products: RetroPlate 99 – penetrating, water based, odorless liquid, VOC compliant, environmentally safe chemical, will leave no film on surface
  2. Joint Filler:
    - a. Advanced Floor Products: CreteFill Pro 85, Semi-rigid, 2 component, self-leveling, 100% solids, rapid curing, polyurea control joint and crack filler with a 85 Shore-A hardness. Depending on project needs.
  3. Repair Material:
    - a. Advanced Floor Products: CreteFill Spall Repair, 2 component, 100% solids, rapid curing polyurea repair material.
  4. Cleaning Solution:
    - a. Advanced Floor Products: CreteClean Plus
  5. Stain Protector:
    - a. Advanced Floor Products: RetroGuard

## PART 3 - EXECUTION

### 3.1 POLISHING

- A. Polish: Level 3: High sheen, 800 grit. 6 minimum passes, Gloss Reading 50-60.

- B. Aggregate Exposure: B, Fine aggregate exposure with little or no medium aggregate at random locations.
- C. Apply polished concrete finish system to cured and prepared slabs.
  - 1. Machine grind floor surfaces to receive polished finishes level and smooth.
  - 2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
  - 3. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
  - 4. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
  - 5. Control and dispose of waste products produced by grinding and polishing operations.
  - 6. Neutralize and clean polished floor surfaces.

### 3.1 PROTECTING

- A. Protect installed product (Polished floors) from damage during construction

END OF SECTION 033543

051200 STRUCTURAL STEEL FRAMING  
054000 COLD-FORMED METAL FRAMING  
055000 METAL FABRICATIONS  
057500 DECORATIVE FORMED METAL

METALS

division **5**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS



**SECTION 051200 - STRUCTURAL STEEL FRAMING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

**A. Section Includes:**

1. Structural steel.
2. Grout.

**1.2 DEFINITIONS**

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

**1.3 PREINSTALLATION MEETINGS**

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

**1.4 ACTION SUBMITTALS**

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

**1.5 INFORMATIONAL SUBMITTALS**

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

**1.6 QUALITY ASSURANCE**

- A. Fabricator Qualifications:** A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).
- B. Installer Qualifications:** A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 360.
  - 3. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

## PART 2 - PRODUCTS

### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M.
- B. Channels, Angles: ASTM A 36/A 36M.
- C. Plate and Bar: ASTM A 36/A 36M.
- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, **Grade B**, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
- F. Welding Electrodes: Comply with AWS requirements.

### 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

### 2.3 PRIMER

- A. Primer: Comply with Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."

### 2.4 GROUT

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

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
- B. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

## 2.6 SHOP CONNECTIONS

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

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
  - 2. Surfaces to be field welded.
  - 3. Surfaces of high-strength bolted, slip-critical connections.
  - 4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 5. Galvanized surfaces.
  - 6. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning." **(All Exposed Steel)**
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

## 2.8 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

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

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  1. Set plates for structural members on wedges, shims, or setting nuts as required.
  2. Weld plate washers to top of baseplate.
  3. Snug-tighten, unless indicated to be pretensioned, anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

### 3.3 FIELD CONNECTIONS

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

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.

END OF SECTION 051200

## SECTION 054000 - COLD-FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 SUMMARY

A. This Section includes the following:

1. Load-bearing wall framing.

#### 1.2 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 on the plans.
2. Deflection Limits: Design framing systems to withstand **design loads** without deflections greater than the following:
  - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of **1/240** of the wall height.
  - b. Interior Load-Bearing Wall Framing: Horizontal deflection of **1/240** of the wall height under a horizontal load of **5 lbf/sq. ft. (239 Pa)**.
  - c. Exterior Non-Load-Bearing Framing: Horizontal deflection of **1/240** of the wall height.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of 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.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification data.
- B. Welding certificates.
- C. Product test reports.
- D. Research/evaluation reports.

1.5 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.
- B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code-Sheet Steel."
- C. 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.
- D. 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 - Header Design."

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: **ST33H**
  - 2. Coating: **G60 (Z180), or equivalent.**

2.2 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: **0.0329 inch (0.84 mm).**
  - 2. Section Properties: **As required by design and indicated on plans.**
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and same minimum base-metal thickness as steel studs.
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: **0.0428 inch (1.09 mm).**
  - 2. Minimum Flange Width: **1-5/8 inches (41 mm).**
  - 3. Section Properties: **As required by design and indicated on plans.**

## 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: **0.0329 inch (0.84 mm)**
  - 2. Minimum Flange Width: **1-5/8 inches (41 mm)**
  - 3. Section Properties: **As required by design and indicated on plans.**
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.
- 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.
- 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.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

## 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, unless otherwise indicated.
- B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- C. Anchor Bolts: ASTM F 1554, Grade **36**, threaded carbon-steel, **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.**
- D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
- E. 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 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.



2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: **SSPC-Paint 20** or **ASTM A 780**.
- 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. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, **1/4 inch (6.4 mm)** thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Install load bearing shims or grout between the underside of 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.
- B. 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.

3.2 INSTALLATION, GENERAL

- A. 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.
- B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.
- C. Install framing members in one-piece lengths.
- D. 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.
- E. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- F. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

- H. 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 (1:960)** and as follows:
1. Space individual framing members no more than plus or minus **1/8 inch (3 mm)** from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.3 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
1. Anchor Spacing: **As shown on Plans.**
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of **1/8 inch (3 mm)** between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
1. Stud Spacing: **As shown on Plans.**
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
  2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced **48 inches (1220 mm)**. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of 2 screws into each flange of the clip angle for framing members up to **6 inches (150 mm)** deep.
  2. 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.
  3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 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 shown on plans.**
- 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 deflection tracks and anchor to building structure.
  2. Install double deflection tracks and anchor outer track to building structure.
  3. Connect vertical deflection clips to **infill** studs and anchor to primary building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than **48 inches (1220 mm)** apart. Fasten at each stud intersection.
1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within **12 inches (305 mm)** 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 **48-inch (1220-mm) centers indicated [centers indicated on Shop Drawings]**.
  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 curtain-wall-framing system.

### 3.5 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of **1-1/2 inches (38 mm)**.
  2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than **2 inches (51 mm)** from abutting walls, and as follows:
1. Joist Spacing: [**12 inches (305 mm)**] [**16 inches (406 mm)**] [**19.2 inches (488 mm)**] [**24 inches (610 mm)**]. **As shown on plans.**
- D. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated [**on Shop Drawings**].
1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated [**on Shop Drawings**]. Fasten bridging at each joist intersection as follows:
1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
  2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

**3.6 FIELD QUALITY CONTROL**

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

**3.7 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.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Miscellaneous steel trim.
5. Metal bollards.
6. Loose bearing and leveling plates.

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

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

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

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

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

D. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

- E. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- F. Zinc-Coated Steel Wire Rope: ASTM A 741.
  - 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- G. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm), As indicated.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; 0.108-inch (2.8-mm) 0.079-inch (2-mm)[0.064-inch (1.6-mm) nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B structural steel, Grade 33 (Grade 230); 0.0966-inch (2.5-mm) .0677-inch (1.7-mm) 0.0528-inch (1.35-mm) minimum thickness; hot-dip galvanized after fabrication.
- H. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- I. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- K. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- L. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
- M. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).
- N. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.
  - 2. Provide stainless-steel fasteners for fastening stainless steel.
  - 3. Provide stainless-steel fasteners for fastening nickel silver.
  - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

#### 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. 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.
- F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

#### 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.



**2.6 MISCELLANEOUS FRAMING AND SUPPORTS**

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

**2.7 SHELF ANGLES**

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with zinc-rich primer.

**2.8 METAL LADDERS**

- A. General:
  - 1. Comply with ANSI A14.3.
- B. Steel Ladders:
  - 1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
  - 2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
  - 3. Rungs: 3/4-inch- (19-mm-) diameter steel bars.
  - 4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  - 5. Provide nonslip surfaces on top of each rung.
  - 6. Prime exterior ladders, including brackets and fasteners. Primer specified in Section 099600 "High-Performance Coatings."

**2.9 MISCELLANEOUS STEEL TRIM**

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

- D. Prime exterior miscellaneous steel trim with zinc-rich primer, or primer specified in Section 099600 "High-Performance Coatings" as indicated.

**2.10 METAL BOLLARDS**

- A. Fabricate metal bollards from Schedule 40 steel pipe.
- B. Prime bollards with primer specified in Section 099600 "High-Performance Coatings."

**2.11 LOOSE BEARING AND LEVELING PLATES**

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

**2.12 LOOSE STEEL LINTELS**

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.
- C. Prime loose steel lintels located in exterior walls with zinc-rich primer, or primer specified in Section 099600 "High-Performance Coating" as indicated.

**2.13 STEEL WELD PLATES AND ANGLES**

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

**2.14 FINISHES, GENERAL**

- A. Finish metal fabrications after assembly.

**2.15 STEEL AND IRON FINISHES**

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with primers specified in Section 099113 "Exterior Painting" unless primers specified in Section 099600 "High-Performance Coatings" are indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

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

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

#### 3.2 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- C. Fill bollards solidly with concrete, mounding top surface to shed water.

**3.3 INSTALLING BEARING AND LEVELING PLATES**

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

**3.4 ADJUSTING AND CLEANING**

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

END OF SECTION 055000

## SECTION 057500 - DECORATIVE FORMED METAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
1. Closures and trim.
  2. Curtainwall filler at mullions
  3. Curtainwall sills

#### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product, including finishing materials.
- B. Shop Drawings: Show fabrication and installation details for decorative formed metal.
1. Include plans, elevations, component details, and attachment details.
  2. Indicate materials and profiles of each decorative formed metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
- C. Samples: For each type of exposed finish required, prepared on 6-inch- (150-mm-) square Samples of metal of same thickness and material indicated for the Work.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For decorative formed metal elements that house items specified in other Sections. Show dimensions of housed items, including locations of housing penetrations and attachments, and necessary clearances.
- B. Evaluation Reports: For post-installed anchors, from ICC-ES.

### PART 2 - PRODUCTS

#### 2.1 SHEET METAL

- A. General: Fabricate products from sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections where exposed to view on finished units.
- B. Aluminum Sheet: Flat sheet complying with ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties of not less than Alloy 5005-H32.

## 2.2 MISCELLANEOUS MATERIALS

- A. Gaskets: As required to seal joints in decorative formed metal and remain airtight and weathertight; as recommended in writing by decorative formed metal manufacturer.
  - 1. ASTM D 1056, Type 1, Class A, grade as recommended by gasket manufacturer to obtain seal for application indicated.
  - 2. Closed-cell polyurethane foam, adhesive on two sides, release paper protected.
- B. Sealants, Exterior: Elastomeric sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- C. Sealants, Interior: Nonsag, paintable sealant complying with Section 079200 "Joint Sealants" and as recommended in writing by decorative formed metal manufacturer.
- D. Filler Metal and Electrodes: Provide type and alloy of filler metal and electrodes as necessary for strength, corrosion resistance, and compatibility in fabricated items.
  - 1. Use filler metals that will match the color of metal being joined.
- E. Fasteners: Fabricated from same basic metal and alloy as fastened metal unless otherwise indicated.
  - 1. Provide Phillips, square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.
- F. Anchors: Provide fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
- G. Anchor Materials:
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) or Group 2 (A4) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- H. Laminating Adhesive: Adhesive recommended by metal fabricator that will fully bond metal to metal and is noncombustible after curing.
- I. Isolation Coating: Manufacturer's standard.

## 2.3 PAINTS AND COATINGS

- A. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

## 2.4 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble decorative formed metal items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

- B. Fold back exposed edges of unsupported sheet metal to form a 1/2-inch- (12-mm-) wide hem on the concealed side, or ease edges to a radius of approximately 1/32 inch (1 mm) and support with concealed stiffeners.
- C. Increase metal thickness or reinforce with concealed stiffeners, backing materials, or both, as needed to provide surface flatness and sufficient strength for indicated use.
  - 1. Support joints with concealed stiffeners as needed to hold exposed faces of adjoining sheets in flush alignment.
- D. Where welding or brazing is indicated, weld or braze joints and seams continuously. Grind, fill, and dress to produce smooth, flush, exposed surfaces in which joints are not visible after finishing is completed.

## 2.5 CLOSURES AND TRIM

- A. Form closures and trim from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction, with weathertight joints at exterior installations.
  - 1. Aluminum Sheet: 0.063 inch (1.60 mm).
    - a. Finish: Dark bronze anodic finish at brake metal trim for curtainwall jambs & head.
    - b. Finish: Baked enamel, powder coat, siliconized polyester or High-performance organic coating. Color to match adjoining curtainwall/storefront.

## 2.6 CURTAINWALL FILLER AT MULLIONS

- A. Form filler to match curtainwall mullion width from metal of type and thickness indicated below. Fabricate to fit tightly to adjoining construction.
  - 1. Aluminum Sheet: 0.063 inch (1.60 mm).
  - 2. High-Performance Organic Finish:
    - a. Color and Gloss: Kawneer, Dark Bronze Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## 2.7 CURTAINWALL SILL FLASHING

- A. Form curtainwall sills from metal of type and thickness indicated below, with end dams:
  - 1. Aluminum Sheet: 0.063 inch (1.60 mm).
    - a. Finish: Dark bronze anodic.

## 2.8 ALUMINUM FINISHES

- A. Dark Bronze Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

- B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  - 1. Color and Gloss: As indicated by manufacturer's designations to match Composite Metal Panel color.
- C. Siliconized Polyester Finish: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
  - 1. Color and Gloss: As indicated by manufacturer's designations to match Composite Metal Panel color.
- D. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 50 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As indicated by manufacturer's designations to match Composite Metal Panel color.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Locate and place decorative formed metal items level and plumb and in alignment with adjacent construction. Perform cutting, drilling, and fitting required to install decorative formed metal.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where needed to protect metal surfaces and to make a weathertight connection.
- C. Form tight joints with exposed connections accurately fitted together. Provide reveals and openings for sealants and joint fillers as indicated.
- D. Corrosion Protection: Apply bituminous paint or other permanent separation materials on concealed surfaces where metals would otherwise be in direct contact with substrate materials that are incompatible or could result in corrosion or deterioration of either material or finish.
- E. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 057500



072100 SOUND INSULATION  
079200 JOINT SEALANTS

THERMAL & MOISTURE PROTECTION

division **7**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 072100 - SOUND INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Glass-fiber blanket.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Low-emitting product certification.

1.3 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Research reports.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET

- A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
  - 1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.
  - 2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.
- B. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Owens Corning.
  - 2. At 3-5/8" steel stud walls provide R-13 (sound attenuation) blankets.

## 2.2 ACCESSORIES

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

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

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

### 3.2 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
  - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  - 3. Maintain 3-inch (76-mm) 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 (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

END OF SECTION 072100

SECTION 079200 - 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. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
  - a. Control and expansion joints on exposed interior surfaces of exterior walls.
  - b. Perimeter joints of exterior openings where indicated.
  - c. Control and expansion joints in ceiling and overhead surfaces.
  - d. Tile control and expansion joints.
  - e. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
  - f. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
  - g. Joints between interior partitions and concrete floors.
  - h. Other joints indicated.
- 2. Interior Joints in the following horizontal traffic surfaces:
  - a. Control and expansion joints in cast-in-place concrete slabs.
  - b. Control and expansion joints in tile flooring.
  - c. Other joints indicated.
- 3. All joints between dissimilar materials.

- B. Related Sections:

- 1. Division 7 Section "Firestopping" for fire-resistant building joint-sealant systems.
- 2. Division 9 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
- 3. Division 9 Section "Acoustical Panel Ceilings" for sealing edge moldings at perimeters of acoustical ceilings.

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.
- B. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

**1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
  - 1. Use manufacturers standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
    - a. Perform tests under environmental conditions replicating those that will exist during installation.
  - 2. Submit not fewer than nine pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 4. For materials failing tests, obtain joint sealant manufacturers written instructions for corrective measures, including the use of specially formulated primers.
  - 5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicated 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.

## 1.7 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.
  - 2. When joint substrates are wet.
- 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.

## 1.8 WARRANTY

- A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Three years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Ten years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
  - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 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 joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Custom as selected by Architect.

## 2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class and uses.
- B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

## 2.3 SOLVENT-RELEASE JOINT SEALANTS

- A. Acrylic-Based Solvent-Release Joint-Sealant Standard: Comply with ASTM C 1311 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.
- B. Butyl-Rubber-Based Solvent-Release Joint-Sealant Standard: Comply with ASTM C 1085 for each product of this description indicated in the Solvent-Release Joint-Sealant Schedule at the end of Part 3.

## 2.4 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

## 2.5 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 C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Type C: Closed-cell material with a surface skin
- D. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to an optimum sealant performance.
- E. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint

surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. All joints of dissimilar materials to receive joint sealant.
- B. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- C. 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 substrates include the following concrete, masonry, or unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants to metal, glass, porcelain enamel or glazed surfaces of ceramic tile



- 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 in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  - 1. Do not leave gaps between ends of sealant backings.
  - 2. Do not stretch, twist, puncture, or tear sealant backings.
  - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  - 1. Place sealants so they directly contact and fully wet joint substrates.
  - 2. Completely fill recesses in each joint configuration.
  - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
  - 4. Seal abutting joint at all dissimilar materials.
- F. 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 sealant from surfaces adjacent to joints.
  - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  - 3. Provide concave joint profile per Figure 5A in ASTM C 1193, unless otherwise indicated.
  - 4. Provide flush joint profile where indicated per Figure 5B in ASTM C 1193, where indicated.
  - 5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.

- a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 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 original work.

### 3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Medium-Modulus Neutral-Curing Silicone Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products:

- a. 791; Dow Corning.
- b. PSI-631; Polymeric Systems, Inc.
- c. Sonolastic 150, Sonneborn.
- d. Spectrem 2; Tremco.

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.

4. Use Related to Exposure: NT (nontraffic).

5. Use Related to Joint Substrates: G (glass), A (aluminum), and, as applicable to joint substrates indicated, O (other).

- a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

7. Applications: Exterior and interior joints in vertical surfaces of concrete; between metal and concrete and mortar; perimeter of metal frames in exterior walls; overhead or ceiling joists.

- B. Mildew-Resistant Silicone Sealant: Where joint sealants of this type are indicated, provide products formulated with fungicide that are intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposure of high humidity and temperature extremes, and that comply with the following:

1. Products:

- a. 786 Mildew Resistant; Dow Corning.
  - b. Omniplus, Sonneborn.
  - c. Sanitary 1700; GE Silicones.
  - d. Tremsil 600 White; Tremco.
  - e. Sololastic 150, Sonneborn.
2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 25.
  4. Use Related to Exposure: NT (nontraffic).
  5. Use Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.
    - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, and ceramic tile.
  6. Applications: Interior joints in vertical surfaces of ceramic tile in toilet rooms, and showers.
- C. Multicomponent Pourable Urethane Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
1. Products:
    - a. Vulkem 245; Mameco International.
    - b. Elasto-Thane 920 Pourable; Pacific Polymers, Inc.
    - c. Sikaflex – 2c SL; Sika Corporation.
    - d. SL 2; Sonneborn Building Products Div., Chem Rex Inc.
  2. Type and Grade: M (multicomponent) and P (pourable).
  3. Class: 25.
  4. Use Related to Exposure: T (traffic) and NT (nontraffic).
  5. Use Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.
    - a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.
  6. Applications: Traffic joints.
- D. Single-Component Nonsag Urethane Sealant: Where joints sealants of this type are indicated, provide products complying with the following:
1. Products:
    - a. Vulkem 921; Mameco International.
    - b. Dynatrol I; Pecora Corporation.
    - c. DyMonic; Tremco.
    - d. NP1; Sonneborn.
  2. Type and Grade: S (single component) and NS (nonsag).
  3. Class: 25.
  4. Use Related to Exposure: NT (nontraffic).
  5. Use Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

- a. Use O Joint Substrates: Coated glass, color anodic aluminum, aluminum coated with a high-performance coating, galvanized steel, brick and masonry, ceramic tile, and wood.

6. Applications: Joints in concrete.

### 3.7 LATEX JOINT-SEALANT SCHEDULE

- A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:

1. Products:

- a. AC-20; Pecora Corporation.
- b. Sonolac; Sonneborn Building Products Div., Chem Rex Inc.
- c. Tremflex 834; Tremco.

2. Applications: Interior joints in field-painted vertical and overhead surfaces at hollow metal door frames, gypsum drywall, and concrete; and all other locations not indicated otherwise.

### 3.8 SMOKE AND ACOUSTIC SEALANT

- A. Smoke and Acoustical Sealant for Joints between metal decks and walls (non-fire rated):  
Where joint sealants of this type are indicated, provide products complying with the following:

1. Products (where flutes are parallel to the wall):

- a. Provide CP767 Speed Strips pre-formed mineral wool plugs by Hilti if required.
- b. CP 506 Smoke and Acoustic Sealant; Hilti.

2. Products (where flutes are perpendicular to the wall):

- a. Provide CP777 Speed Strips pre-formed mineral wool plugs by Hilti. Press into flutes.
- b. CP 572 Smoke and Acoustic Sealant; Hilti.

END OF SECTION

081113 HOLLOW METAL DOOR FRAMES  
087100 DOOR HARDWARE  
088000 GLAZING

DOORS & WINDOWS



SECTION 081113 - HOLLOW METAL DOOR FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes hollow-metal work.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.3 ACTION SUBMITTALS

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

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. Amweld International, LLC.
2. Apex Industries, Inc.
3. Ceco Door Products; an Assa Abloy Group company.
4. Commercial Door & Hardware Inc.
5. Concept Frames, Inc.
6. Curries Company; an Assa Abloy Group company.
7. Custom Metal Products.
8. Daybar.
9. Deansteel.
10. de La Fontaine Industries.
11. DKS Steel Door & Frame Sys. Inc.
12. Door Components, Inc.
13. Fleming-Baron Door Products.
14. Gensteel Doors Inc.
15. Greensteel Industries, Ltd.
16. HMF Express.
17. Hollow Metal Inc.
18. Hollow Metal Xpress.
19. J/R Metal Frames Manufacturing, Inc.
20. Karpen Steel Custom Doors & Frames.
21. L.I.F. Industries, Inc.
22. LaForce, Inc.
23. Megamet Industries, Inc.

24. Mesker Door Inc.
25. Michbi Doors Inc.
26. MPI Group, LLC (The).
27. National Custom Hollow Metal.
28. North American Door Corp.
29. Philipp Manufacturing Co (The).
30. Pioneer Industries, Inc.
31. Premier Products, Inc.
32. Republic Doors and Frames.
33. Rocky Mountain Metals, Inc.
34. Security Metal Products Corp.
35. Shanahans Manufacturing Ltd.
36. Steelcraft; an Ingersoll-Rand company.
37. Steward Steel; Door Division.
38. Stiles Custom Metal, Inc.
39. Titan Metal Products, Inc.
40. Trillium Steel Doors Limited.
41. West Central Mfg. Inc.

## 2.2 REGULATORY 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 and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  1. Smoke- and Draft-Control Assemblies: Provide an assembly 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.

## 2.3 INTERIOR FRAMES

- A. Heavy-Duty Frames: SDI A250.8, Level 2.
  1. Physical Performance: Level B according to SDI A250.4.
  2. Frames:
    - a. Materials: Uncoated, and Metallic-coated, steel sheet, minimum thickness of 0.053 inch (1.3 mm).
    - b. Construction: Knocked down and Slip-on drywall.
  3. Exposed Finish: Prime.

## 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2

- inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
  3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.5 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
  1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- F. Power-Actuated Fasteners in Concrete: From corrosion-resistant materials.
- G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing).
- I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat.

## 2.6 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.



1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

C. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: SDI A250.10.

## 2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than **0.016 inch (0.4 mm)** thick.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

A. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
  - a. At fire-rated openings, install frames according to NFPA 80.
  - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
  - c. Install frames with removable stops located on secure side of opening.
  - d. Install door silencers in frames before grouting.
  - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
  - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
  - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
  - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

### 3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 08 Section "Flush Wood Doors".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.2 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.
- 1.3 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
  - B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
  - D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
  - E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
  - F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
    - 1. Function of building, purpose of each area and degree of security required.
    - 2. Plans for existing and future key system expansion.
    - 3. Requirements for key control storage and software.
    - 4. Installation of permanent keys, cylinder cores and software.
    - 5. Address and requirements for delivery of keys.
  - G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
    - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
    - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
    - 3. Review sequence of operation narratives for each unique access controlled opening.
    - 4. Review and finalize construction schedule and verify availability of materials.
    - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
  - H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
  - B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.5 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.6 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten years for locks and latches.
  - 2. Five years for exit hardware.
  - 3. Twenty five years for manual surface door closer bodies.
  - 4. Five years for motorized electric latch retraction exit devices.
  - 5. Two years for electromechanical door hardware.

#### 1.7 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
  - 1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  - 4. Hinge Options: Comply with the following:

- a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Acceptable Manufacturers:
- a. Hager Companies (HA).
  - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
- B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 certified pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed teflon coated stainless pin, and twin self lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Acceptable Manufacturers:
- a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
  - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
  - c. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

## 2.3 DOOR OPERATING TRIM

- A. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  5. Acceptable Manufacturers:
    - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - b. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.



2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Manufacturer's Standard.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. New System: Key locks to a new key system as directed by the Owner.
- E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide construction master keyed cylinders.
- G. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.
- H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Acceptable Manufacturers:
    - a. Lund Equipment (LU).
    - b. MMF Industries (MM).
    - c. Telkee (TK).
- 2.5 MECHANICAL LOCKS AND LATCHING DEVICES
- A. Bored Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
1. Acceptable Manufacturers:
    - a. Sargent Manufacturing (SA) – 11 Line.

## 2.6 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
1. Strikes for Mortise Locks and Latches: BHMA A156.13.
  2. Strikes for Bored Locks and Latches: BHMA A156.2.
  3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
  4. Dustproof Strikes: BHMA A156.16.

## 2.7 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) - 351 Series.
- b. Norton Door Controls (NO) - 7500 Series.

## 2.8 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Acceptable Manufacturers:
  - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
  - b. Trimco (TC).

## 2.9 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Acceptable Manufacturers:
    - a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - b. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:
  - a. Rixson Door Controls (RF).
  - b. Sargent Manufacturing (SA).

## 2.10 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: 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 UL-10C.
  1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
  1. National Guard Products (NG).
  2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
  3. Reese Enterprises, Inc. (RE).

## 2.11 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.12 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 3.2 PREPARATION

- A. Wood Doors: Comply with ANSI/DHI A115-W series.

#### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9

Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

- D. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 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.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should 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 and functionality.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - Sargent
5. NO - Norton

Hardware Sets

Set: 1.0

3 Hinge	TA2714 (NRP)	US26D	MK
1 Classroom Lock w/ RA Keyway	737-B	US26D	SA
1 Surface Closer	7500	689	NO
2 Kick Plate	K1050 10"	US32D	RO
2 Stretcher Plate	K1050 12"	US32D	RO
1 Door Stop	409	US32D	RO
3 Silencer	608-RKW		RO
1 Gasketing	S44BL		PE

Set: 2.0

3 Hinge	TA2714	US26D	MK
1 Passage Set	715-B	US26D	SA
1 Surface Closer	7500	689	NO
2 Kick Plate	K1050 10"	US32D	RO
2 Stretcher Plate	K1050 12"	US32D	RO
3 Silencer	608-RKW		RO
1 Gasketing	S44BL		PE

Set: 3.0

1 Rim Exit Device & Latch	8813xB	US26D	SA
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END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
  - 1. Glass for doors and hollow metal framing.
  - 2. Glazing sealants and accessories.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

- A. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.



- B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- 2.2 Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in the Insulating Glass Schedule or comparable product by one of the following:
  - 1. Northwestern Industries, Inc.
  - 2. Oldcastle BuildingEnvelope™.
  - 3. PPG Industries, Inc.

### 2.3 PERFORMANCE REQUIREMENTS

- A. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

### 2.4 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
  - 2. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
  - 3. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.5 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  - 1. Spacer material and construction with aluminum with mill or clear anodic finish.

## 2.6 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  - 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. Dow Corning Corporation.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.
    - c. Sika Corporation.
  - 2. Applications: User related to exposure: NT (nontraffic).

## 2.7 GLAZING TAPES

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

## 2.8 MISCELLANEOUS GLAZING MATERIALS

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

## PART 3 - EXECUTION

### 3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

### 3.2 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

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

### 3.3 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- 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. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.4 SEALANT GLAZING (WET)

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

3.5 CLEANING AND PROTECTION

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

3.6 MONOLITHIC GLASS SCHEDULE

- A. Glass Type **(GL-1)**: Clear float glass.
  - 1. Minimum Thickness: ¼ inch.
- B. Glass Type **(GL-2)**: Clear fully tempered float glass.
  - 1. Minimum Thickness: ¼ inch.
  - 2. Safety glazing required.

END OF SECTION 088000

092200 NON-LOAD-BEARING STEEL FRAMING  
092900 GYPSUM BOARD  
095100 ACOUSTICAL PANEL CEILINGS  
096513 RESILENT BASE & ACCESSORIES  
096813 TILE CARPETING  
099123 PAINTING

FINISHES

division **9**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 092200 – NON-LOAD-BEARING STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes non-load-bearing steel framing members for the following applications:
  - 1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
  - 2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- C. Flat Hangers: Steel sheet, in size indicated on Drawings 1 by 3/16 inch by length indicated.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch wide flanges.
  - 1. Depth: 2-1/2 inches

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053 bare-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.
  - a. Minimum Base-Metal Thickness: 0.033 inch.
  - b. Depth: As indicated on Drawings
3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
  - a. Minimum Base Metal Thickness: 0.033 inch
4. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
  - a. Configuration: Asymmetrical

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
  - b. Chicago Metallic Corporation; Drywall Furring System.
  - c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner 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. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
    - 2) Superior Metal Trim; Superior Flex Track System (SFT).



- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.033 inch
- D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: 1-1/2 inches
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.033 inch
  - 2. Depth: 7/8 inch
- F. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical
- G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: 3/4 inch
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.033 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch

## 2.4 AUXILIARY MATERIALS

- A. Fasteners for Metal 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 D 226, 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 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

### 3.2 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. 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. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 4. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- E. 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.
- F. 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.

### 3.3 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

- a. Install two studs at each jamb, unless otherwise indicated.
  - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
  - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
- C. 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.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092200

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Aluminum trim and reveals.

B. Related Sections:

1. Section 095113 – Perimeter Transition Blind Pocket Systems for drywall ceiling flange installations.

1.2 ACTION SUBMITTALS

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

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 INTERIOR GYPSUM BOARD

- 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. American Gypsum Co.
2. CertainTeed Corp.
3. GP Gypsum LLC.
4. National Gypsum Company.
5. PABCO Gypsum.
6. Temple-Inland.
7. USG Corporation.

- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch
2. Long Edges: Tapered.

C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.3 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 Corner Bead.
3. Material: Vinyl conform to ASTM D-1784.
  - a. Available Manufacturers include but are not limited to:  
AMICO (Alabama Metal Industries Corporation)  
Tel: 1-800-366-2642  
[www.amico-lath.com](http://www.amico-lath.com)
4. Shapes: Zip Strip bead.

B. Aluminum Trim and Reveals: Extruded accessories of profiles and dimensions 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. Fry Reglet Corp.
  - b. Gordon, Inc.
  - c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.

3. Finish: Clear Anodized
4. Where reveals in wall plane intersect, provide factory fabricated intersection pieces including inside corners and cross intersections. Legs of fabricated pieces shall be a minimum of 6 inches long, provide connector clips where intersection pieces about running trim.

## 2.4 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Board: Paper (fiberglass joint tape not permitted)
  2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- 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.

## 2.5 AUXILIARY MATERIALS

- A. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. 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 (0.84 to 2.84 mm) thick.
- C. Acoustical Sealant: As specified in Division 7 "Joint Sealants."
- D. Thermal Insulation: As specified in Division 7 "Building Insulation."
- E. Vapor Retarder: Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick, with maximum permeance rating of 0.13 perm.
  1. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

## PART 3 - EXECUTION

### 3.1 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 (1.5 mm) 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. (0.7 sq. m) 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- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) 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.

### 3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Type X: Vertical surfaces unless otherwise indicated.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.

- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.3 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 according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners, unless otherwise indicated.
  2. Bullnose Bead: Use at outside corners.
  3. LC-Bead: Use at exposed panel edges.
  4. L-Bead: Use where indicated.
  5. U-Bead: Use at exposed panel edges.
  6. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.



### 3.4 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, rounded or beveled edges, 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:** Concealed areas, and where indicated.
  - 2. **Level 2:** Panels that are substrate for tile. Panels that are substrate for acoustical tile.
  - 3. **Level 3:** Panels that are substrate for wall covering and wall panels in mechanical plenums and spaces above ceilings used for air movement.
  - 4. **Level 4:** At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 9 sections
  - 5. **Level 5:** In areas with oblique lighting such as lobby walls. Also, on walls to receive deep tone paints or paints with a high gloss level higher than "flat".
    - a. Primer and its application to surfaces are specified in other Division 9 "section

### 3.5 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.

END OF SECTION 092900

SECTION 095100 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes acoustical ceiling tile, suspension system and accessories.
- B. Related Sections:
  - 1. Section 095113 – Perimeter Transition Blind Pocket Systems for acoustical ceiling flange installations.

1.2 QUALITY ASSURANCE

- A. 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.
- B. Fire Performance Characteristics: Provide acoustical ceiling components that are identical to those tested for the following fire performance characteristics, according to ASTM test method indicated, by UL or other testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.
  - 1. Surface Burning Characteristics: As follows, tested per ASTM E 84.
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 50 or less.
  - 2. Fire Resistance Ratings: As indicated by reference to design designation in UL "Fire Resistance Directory" or "FM Approval Guide", for floor, roof or beam assemblies in which acoustical ceilings function as a fire protective membrane; tested per ASTM E 119. Provide protection materials for lighting fixtures and air ducts to comply with requirements indicated for rated assembly.
- C. Seismic Standard: Provide acoustical panel ceilings designed and installed to withstand the effects of earthquake motions according to the following:
  - 1. CISA'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."
- D. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other work supported by or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or 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.

1.4 PROJECT CONDITIONS

- A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings completed, and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy

1.5 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.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packed with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Panels: Full-size equal to 2.0 percent of quantity installed.
  - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.
  - 3. Hold-Down Clips: Equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include:
  - 1. Suspension System:
    - a. **See Finish Schedule**
  - 2. Acoustical Tile

a. **See Finish Schedule**

3. Acoustical Sealant:

- a. Tremco Acoustical Sealant; Tremco.
- b. USG Acoustical Sealant; United States Sypsum Co.
- c. Chem-Calk 600; Woodmont Products, Inc.
- d. Pecora Corp; AC 20 FTR Acoustical and Insulation Sealant

2.2 MATERIALS

A. Acoustical Ceiling Units:

1. General: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC's as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).
2. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.
3. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-11 "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

B. Ceiling Types:

1. **See Finish Schedule.**

C. Metal Suspension System: Provide metal suspension systems of type, structural classification and finish indicated which comply with applicable ASTM C 635 requirements.

1. Finishes and Colors: Provide manufacturer's standard finish for type of system indicated, unless otherwise required. For exposed suspension members and accessories with painted finish, provide color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's full range of standard colors.
2. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.
3. Hanger Wire: Galvanized carbon steel wire, ASTM A 641, soft temper, pre-stretched, Class 1 coating, sized so that stress at 3- times hanger design load (ASTM C 635, Table 1, Direct Hung), will be less than yield stress of wire, but provide not less than 12 gage.
4. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.
  - a. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - b. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
  - c. Provide shadow reveal molding with width of reveal equal to depth of reveal.

- d. Colors of Moldings and Trims: As selected by Architect.
- 5. Hold-Down Clips: Minimum 24 gauge spring steel, 1-7/16 inches deep x 7/8 inches wide, designed to fit over cross tees. Provide clips spaced symmetrically 2 ft. o.c..
- 6. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces. Struts will be required at 12 feet on center both ways for all suspended ceilings according to UBC Standard 25-2. (Seismic calculations have been done which require rigid struts as 12 feet on center in order to allow for 7/8" perimeter wall molding in lieu of a 2" perimeter wall mold.) In lieu of compression struts provide a seismic clip with an ES Report number from ICC demonstrating that the compression struts and the 2 inch perimeter wall mold are not required. Equal to;
  - a. BERC seismic clips as manufactured by Armstrong.
  - b. 1496 Perimeter Clip as manufactured by Chicago Metallic Corp.
  - c. ACM-7 clip as manufactured by USG.
- 7. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 (Z90) coating designation, with pre-finished 15/16-inch-(24-mm-) wide metal caps on flanges.
  - a. Basis of Design: **See finish Schedule**
  - b. Structural Classification: Heavy-duty system.
  - c. End Condition of Cross Runners: Butt-edge type.
  - d. Face Design: Flat, flush.
  - e. Cap Material: Steel or aluminum cold-rolled sheet.
  - f. Cap Finish: Painted in color as selected from manufacturer's full range.
    - 1) Colors:
      - (a) White.

D. Miscellaneous Materials:

- 1. Acoustical Sealant: Resilient, non-staining, non-shrinking, non-hardening, non-skinning, non-drying, non-sag sealant intended for interior sealing of concealed construction joints.
- 2. Edge Trim:
  - a. Basis of Design: Armstrong Ceilings; Axiom.
  - b. Trim Height: 4 inches.
  - c. Finish: As selected by Architect from manufacturer's full range of custom colors.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordination: Furnish layouts for inserts, clips, or other supports required to be installed by other trades for support of acoustical ceilings.
  - 1. Furnish concrete inserts, steel deck hanger clips and similar devices to other trades for installation well in advance of time needed for coordination of other work.

- B. Layout: Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

### 3.2 INSTALLATION

- A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.
- B. Arrange acoustical units and orient directionally- patterned units (if any) in manner shown by reflected ceiling plans.
  - 1. Install tile with pattern running in one direction.
- C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6" from each end and spaced 4'-0" along each carrying channel or direct-hunger runner, unless otherwise indicated, leveling to tolerance of 1/8" in 12'-0". Comply with detail on drawings for seismic bracing.
- D. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screw, or other devices which are secure and appropriate for substrate and which will not deteriorate or fail with age or elevated temperatures.
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum which are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal force by bracing, countersplaying or other equally effective means.
- E. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
  - 1. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.
- F. Install acoustical tile in coordination with suspension system into kerfed edges, or insert tile tongues into tile grooves, so that every tile-to-tile joint is closed by double lap of material.
  - 1. Fit adjoining tile to form flush, tight joints. Scribe and cut for accurate fit at borders and around penetrating work.
  - 2. Hold tile field in compression by inserting leaf-type spring steel spacers between tile and moldings, spaced at 12" o.c.
  - 3. Install acoustical panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.
  - 4. Paint cut and exposed edges of acoustical tile.
  - 5. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire-resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.3 ADJUST AND CLEAN

- A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work with cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095100

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Subfloor leveler.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. FloorScore Compliance: Resilient base shall comply with requirements of FloorScore certification.
- B. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOPLASTIC-RUBBER BASE: RB-1

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Group: II (layered).
  - 2. Style and Location:
    - a. Style, Standard Toe.
- C. Thickness: 0.125 inch (3.2 mm)
- D. Height: 4 inches (102 mm).



- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Colors: **See Finish Schedule.**

**2.3 THERMOPLASTIC SUBFLOOR LEVELER:**

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Roppe Corporation, USA.
- B. Product
  - 1. Subfloor Leveler, #302 or #304, depending on height transition required.
- C. Thickness: Varies, cut to fit if required.
- D. Lengths: 48", cut to fit.

**2.4 INSTALLATION MATERIALS**

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.

- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. Preformed Corners: Install preformed corners before installing straight pieces.
- G. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Miter or cope corners to minimize open joints.

### 3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096813 - TILE CARPETING

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 modular, fusion-bonded carpet tile.
- B. Related Sections include the following:
  - 1. Division 9 Section "Finish Schedule" for product selections and colors.
  - 2. Division 9 Section "Resilient Base and Accessories" for rubber subfloor leveler.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristic, durability, and fade resistance. Include installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
  - 1. Carpet tile type, color, and dye lot.
  - 2. Pile direction.
  - 3. Type, color, and location of insets and borders.
  - 4. Type, color, and location of edge, transition, and other accessory strips.
  - 5. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and other Accessory Stripping: 12-inch- (300-mm-) long samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.
- F. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, 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 tile.

G. Warranty: Special warranty specified in this Section. .

#### 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. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  2. Include installation recommendations for each type of substrate.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Product Options: "Products and manufacturers named in Part 2 establish requirements for product quality in terms of appearance, construction, and performance. Other manufacturers' products comparable in quality to named products and complying with requirements may be considered.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI "Carpet Installation Standard – 2011". Section 5, "Storage and Handling."

#### 1.6 PROJECT CONDITIONS

- A. Comply with CRI "Carpet Installation Standard – 2011", Section 7.2, "Site Conditions – All Installations" and Section 11, "Ventilation."
- B. Environmental Limitations: Do not install carpet tiles 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.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

#### 1.7 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, dimensional stability, and delamination.
3. Warranty Period: Lifetime Commercial Limited.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m.).

### PART 2 - PRODUCTS

#### 2.1 CARPET TILE

- A. Acceptable Manufacturer: Subject to compliance with requirements of Contract Documents, provide products by manufacturer listed below;
  1. Manufacturer: See Finish Schedule
  2. Product: See Finish Schedule

#### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- 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 carpet tile 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 REPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

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 carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile 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 tile manufacturer.

E. Extend carpet tile 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. Pattern as determined by Architect prior to beginning installation

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile 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 tile manufacturer.

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Steel and iron. (Door frames & Partitions Screens)
  - 2. Gypsum board.

1.2 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.

1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.



1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
  - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
  - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

**B. PRODUCT VERIFICATION: PAINT CANS OF THE SPECIFIED MATERIALS WILL BE VERIFIED ON SITE BY ARCHITECT. ARCHITECT RESERVES THE RIGHT TO REQUEST INVOICES OF PRODUCTS BEING INSTALLED.**

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 Basis-of-Design Product: Subject to compliance with requirements, provide product indicated within the Interior Painting Schedule or comparable product by one of the following:

1. Benjamin Moore & Co.
2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
3. Sherwin-Williams Company (The). "Basis of Design":

- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.3 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.

4. Primers, Sealers, and Undercoaters: 200 g/L.
  5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
  6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
  7. Pretreatment Wash Primers: 420 g/L.
  8. Floor Coatings: 100 g/L.
  9. Shellacs, Clear: 730 g/L.
  10. Shellacs, Pigmented: 550 g/L.
- D. Low-Emitting Materials: Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Colors: As indicated in Section 090000, "Finish Schedule."
1. Ten percent of surface area will be painted with deep tones.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Concrete: 12 percent.
  2. Fiber-Cement Board: 12 percent.
  3. Masonry (Clay and CMUs): 12 percent.
  4. Wood: 15 percent.
  5. Gypsum Board: 12 percent.
  6. Plaster: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
1. Application of coating indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

### 3.4 INTERIOR PAINTING SCHEDULE

#### A. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:
  - a. Prime Coat: Primer, rust inhibitive, water based MPI #107 X-GREEN
    - 1) "Basis of Design": Sherwin Williams; Pro-Cryl Industrial Acrylic Primer Coating.
  - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #141.
    - 1) "Basis of Design": Sherwin Williams; Pro Industrial High Performance, Acrylic Semi-Gloss Coating.

#### B. Gypsum Board and Plaster Substrates:

1. Institutional Low-Odor/VOC Latex System:
  - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #50.
    - 1) "Basis of Design": Sherwin Williams; ProMar 200 Zero, Interior Latex Primer.
  - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
  - c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5), MPI #43.
    - 1) "Basis of Design": Sherwin Williams; SuperPaint Interior Acrylic Latex, Semi-Gloss Coating.

#### C. Floor Substrates:

1. Institutional Low-Odor/VOC Water-Based Epoxy System:
  - a. First Coat: Water-based epoxy, interior, institutional low odor/VOC, matching topcoat.
  - b. Topcoat: Water-based epoxy, interior, institutional low odor/VOC.

- 1) "Basis of Design": Sherwin Williams; ArmorSeal 8100, B70-8100 Series,  
2.0-4.0 mils per coat.

END OF SECTION 099123

101425 SIGNS

SPECIALTIES

division

10

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

## SECTION 101425 - SIGNS

### 1.1 GENERAL

A. Submittals: Submit the following:

1. Shop Drawings: Provide plans, elevations, and sections showing typical members, anchors, layout, reinforcement, accessories, and installation details. Include the following:
  - a. Message list for each sign with wording and letter layout.
  - b. Setting drawings, templates, and directions for installing.

### 1.2 PRODUCTS

- A. Acrylic Sheet: Cast methyl methacrylate monomer plastic sheet with 16,000-psi minimum flexural strength, and minimum allowable continuous service temperature of 176 deg F (80 deg C).
1. Opaque Sheet: Colored opaque acrylic sheet in colors and finishes indicated.
- C. Vinyl Film: Opaque nonreflective vinyl film, 0.0035-inch minimum, pressure-sensitive adhesive backing, suitable for exterior use.
- D. Applied Copy: Die-cut characters from vinyl film with pressure-sensitive adhesive backing. Apply to exposed face of glass.
1. Letter Height/Style: see product data sheet at end of section.
- E. Colored Coatings for Acrylic Plastic Sheet: Nonfading colored coatings, including inks and paints for copy and background colors.
- F. Graphic Content and Style: Provide sign copy that complies with size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.

### 1.3 EXECUTION

- A. Installation: Locate signs where indicated, using mounting methods specified. Install level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Dimensional Numbers: Mount characters using methods recommended for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
1. Projected Mounting: At distance from wall surface indicated.
- C. Cleaning: After installation, clean soiled surfaces. Protect units from damage until acceptance by the Owner.

D. PRODUCT DATA SHEET

Acrylic panel sign provided by BIGFOOT SIGNS AND GRAPHICS. See example of similar sign below.



SIGNS: Acrylic

Message: **LAB (2 Sets)**  
Room #: 112  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic

Message: **LAB (2 Sets)**  
Room #: 115  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic

Message: **CLASSROOM (1 Set)**  
Room #: 102  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic

SIGNS

Message: **CLASSROOM** (2 Sets)  
Room #: 112C  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic  
Message: **CLASSROOM** (2 Sets)  
Room #: 112D  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic  
Message: **CLASSROOM** (2 Sets)  
Room #: 112E  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

SIGNS: Acrylic  
Message: **CLASSROOM** (2 Sets)  
Room #: 112F  
Type: Acrylic panel sign  
Size: as required  
Mat. Thickness: 1/8"  
Lettering Style: Ribbon.  
Misc.: Braille.

END OF SECTION 101425



213000 FIRE SPRINKLER SYSTEMS

FIRE SUPPRESSION

division **21**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

**SECTION 213000 - FIRE SPRINKLER SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of the contract apply to this section.
- B. Technical sections which describe related work such as Division 26 apply to this section.

**1.2 SUMMARY:**

- A. Furnish all materials, equipment and supplies and perform all work and operations to modify the existing fire sprinkler system to serve the revised classroom area. Provide fire protection for the remodeled areas in the building. The design shall meet the requirements of NFPA 13 and be in accordance with the bid drawings and specifications. Reference to other specifications, codes, standards or manuals which are a part of these specifications, but are not included herein, shall be the latest adopted edition of these publications.

**1.3 QUALITY ASSURANCE:**

- A. Materials, devices and equipment shall be Underwriters Laboratories listed and/or Factory Mutual approved for use in fire protection systems.
- B. Installer: The sub-contractor for each of the fire protection systems shall be duly licensed by the state in which the project is being constructed. The sub-contractor must be engaged in the installation of the types of automatic fire protection systems required for this project and be fully familiar with all local conditions, specified codes and requirements.
- C. Designer: The designer for the fire sprinkler system shall be a staff employee of the "Installer" and shall be a licensed fire protection engineer (Arizona registration) or a Certified Engineering Technician in Fire Protection (NICET level III minimum). The Certification shall be active during the entire contract period. The designer shall certify that the drawings and installation are in accordance with the intent of NFPA 13, the plans and specifications. The designer shall make a complete and final inspection of the installation, including operating all alarms, control valves, checking all piping, seismic bracing, hangers, etc. After checking all components of the system, he shall provide a letter stating that the installation is complete, operational and in accordance with approved plans and specifications. If changes have been made in the installation since the plans were approved, the designer shall correct the shop drawings and provide as-built drawings to the Owner with the letter.

**1.4 SUBMITTALS:**

- A. Shop Drawings: The fire sprinkler contractor shall prepare complete shop drawings for each sprinkler system. Shop drawings shall be coordinated with structure and with all other trades. Show new and existing piping, sprinklers, ceiling grid, lights, grilles, ducts, registers and diffusers, etc. Show heads symmetrically related to ceiling patterns and show heads centered in tiles in grid. The shop drawings shall contain, as a minimum, the information outlined and listed in NFPA 13 chapter 8. Submit fire sprinkler drawings and hydraulic calculations to each Authority Having Jurisdiction for review prior to

starting work. Final design shall incorporate all requirements of the AHJ's. Work only from reviewed documents.

- B. Hydraulic Calculations: Furnish complete hydraulic calculations for the hydraulically most remote area of each different occupancy classification of each fire sprinkler system.
- C. Descriptive Data: Descriptive data shall be submitted on the following items of material and/or equipment. Such data shall consist of manufacturer's or supplier's catalog information in sufficient detail to allow verification that the material and/or equipment meets the specification requirements, or is equal to that specified.
  - 1. Pipe, fittings, couplings, sprinklers.
- D. Submittal Procedure: Prior to ordering or fabricating equipment, prepare shop drawings for submittal to Architect. Submit four sets of drawings and calculations to the Architect for review. After review and acceptance by the Architect, submit to all state and local jurisdictions for review. Any review comments, and associated drawing revisions, from state or local approving authorities that affect the system design shall be approved by the Architect prior to installation.
- E. Upon completion of installation submit to Architect two copies each:
  - 1. As-built shop drawings with designer's signature and certification number. As-Built drawings shall be submitted on Mylar.

**1.5 WORK INCLUDED:**

- A. Design and installation of a new fire sprinkler system including risers, mains, branches and sprinklers to serve the new school / daycare space. Work includes but is not limited to:
  - 1. Design and installation drawings, including hydraulic calculations.
  - 2. Pipe, fittings, hangers and concealed sprinklers throughout the entire building.
  - 3. Spare sprinklers, earthquake bracing, sprinkler trim, testing and documentation.

**1.6 SYSTEM DESCRIPTION:**

- A. New wet-pipe automatic fire sprinkler system to protect the new space as indicated in these specifications and on the project drawings. Work includes but is not limited to the following:
  - 1. Design, furnish and install new fire sprinklers in accordance with NFPA 13 to provide fire protection for all areas in the new building.

**1.7 SYSTEM DESIGN:**

- A. Design densities and areas of application shall meet the minimum requirements of NFPA 13 as outlined below:
  - 1. Classroom Spaces.
    - a. Light hazard, 0.10 gpm/sq. ft over 1,500 sq. ft. with 100 gpm hose allowance.
- B. Maximum coverage per sprinkler head.
  - 1. Light Hazard: 225 sq. ft.
- C. Maximum velocity in hydraulic calculations for fire sprinkler system shall not exceed 20 ft/sec.

1.8 WARRANTY:

- A. Materials, equipment, and workmanship shall be free from defects for 12 months from the "Date Left in Service with All Control Valves Open," shown on "Contractor's Material and Test Certificate." If any Work is found to be defective, Contractor shall promptly, without cost to Owner, and in accordance with Owner's instructions, either correct such defective Work, or if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. Submit two copies of Warranty Certificates to Architect.

1.9 REFERENCES:

- A. NFPA (National Fire Protection Association) 13, "Installation of Sprinkler Systems," 2002.
- B. NFPA 72, "National Fire Alarm Code", 2002.
- C. NFPA 20, "Standard for the Installation of Stationary Fire Pumps for Fire Protection", 1999 edition.
- D. IFC (International Fire Code), 2006.
- E. IBC (International Building Code), 2006.
- F. IBC Standards, 2006.
- G. Underwriters Laboratories "Fire Protection Equipment Directory," current edition.
- H. Factory Mutual Systems "Approval Guide," current edition.

**PART 2 - PRODUCTS**

2.1 Acceptable manufacturers of sprinkler equipment, heads and devices.

- A. Gem.
- B. Reliable.
- C. Victaulic.

2.2 PIPE:

- A. Above Ground Piping:
  - 1. All piping shall be domestic steel schedule 40 piping conforming to ANSI/ASTM A53, ASTM A135 and ASTM A795.

2.3 FITTINGS:

- A. Interior Piping:
  - 1. Cast iron threaded, ANSI B16.4.
  - 2. Cast iron flanged, ANSI B16.1.
  - 3. Malleable iron threaded, ANSI B16.3.

4. Forged steel fittings, socket welded and threaded, ANSI B16.11.
5. Plain end couplings and fittings, saddle couplings, and clamp type couplings are not acceptable.
6. Other types of fittings may be used, but only those investigated and listed for this service **and** approved by the project engineer.

2.4 HANGERS:

- A. Hangers shall conform to the minimum requirements of NFPA 13.

2.5 SEISMIC FITTINGS AND BRACES:

- A. Earthquake bracing is required and shall conform to the minimum requirements of NFPA 13.

2.6 SPRINKLERS:

- A. Areas with finished ceilings shall be semi-recessed, chrome plated type with chrome escutcheon and ordinary temperature. Sprinklers heads shall be located within 2" of the center of the ceiling tiles.
- B. Areas without ceilings shall be brass pendant type.
- C. Sprinklers of intermediate and high temperature ratings shall be installed in specific locations as required by NFPA 13.
- D. All sprinklers installed in areas designated as ordinary hazard shall be quick response type sprinkler heads.
- E. Provide a minimum of one spare head of each type for spare head cabinet and one head wrench for each type sprinkler. The minimum number of spare sprinklers provided shall be in accordance with NFPA 13.
- F. All sprinklers located in storage rooms, mechanical spaces and apparatus bays shall be equipped with safety cages.

**PART 3 - EXECUTION**

3.1 INSPECTION:

- A. Inspect job site prior to fabricating materials. Coordinate and sequence installation with the progress of other mechanical and structural systems and components.

3.2 INSTALLATION:

- A. Install systems in compliance with methods detailed in NFPA 13 including seismic requirements for Area 3.
- B. Offset as needed for other trades. Avoid conflict in areas of tight construction. Do not obstruct access to access doors, lights or other ceiling mounted equipment.

- C. Submit piping and equipment data sheets for review by the Architect/Engineer prior to ordering or fabricating equipment.
- D. Close pipe openings with caps or plugs during installation. Cover and protect components of the system against dirt and chemical or mechanical injury.

**3.3 FIELD QUALITY CONTROL:**

- A. Obtain permits and post bonds as required by state and local AHJ's (Authorities Having Jurisdiction).
- B. Inform AHJ's of job progress. Request presence of AHJ'S, perform tests, and document results using Contractor's Material and Test Certificates.

**3.4 TESTING:**

- A. Hydrostatically test all system piping for two hours at 200 psi (or 50 psi higher than the maximum anticipated static pressure) with no loss in pressure and no visible leakage. Conduct the testing after all of the fire sprinklers and piping are installed. Have the tests witnessed by the AHJ's and Engineer. Submit a Contractor's Material and Test Certificate to the Architect upon successful completion of the testing.

**3.5 CLEANING:**

- A. Remove oil, scale, debris, and foreign substances from interior and exterior of devices, equipment, and materials prior to installation.
- B. Upon job completion, remove tools, surplus materials and equipment, leaving all areas broom clean.

**3.6 ACCEPTANCE:**

- A. Acceptance of installation is subject to final inspection and approval by:
  - 1. State of Arizona Fire Marshal's Office
  - 2. Architect or his representative.

END OF SECTION 213000

- 221000 VALVES
- 224100 WATER DISTRIBUTION PIPING EQUIPMENT
- 224200 DRAINAGE AND VENT SYSTEMS AND EQUIPMENT
- 224400 PLUMBING FIXTURES
- 224500 DOMESTIC WATER HEATERS

PLUMBING

division 22

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

SECTION 221000 - VALVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. This section is Division 22 Valves section, and is part of each Division 22 section making reference to valves specified herein.
- C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. Extent of valves required by this section is indicated on drawings and/or specified in other Division 22 sections.
- B. Types of valves specified in section include the following:
  - 1. Drain Valves.
  - 2. Ball Valves.
  - 3. Miscellaneous Valves.
- C. Valves furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Valve Types: Provide valves of same type by same manufacturer.
- C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.
- B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.



- C. Maintenance Data: Submit maintenance data and spare parts lists for each type of valve. Include this data, product data, and shop drawings in Maintenance Manual; in accordance with requirements of Division 01.

1.5 REFERENCES:

- A. Codes and Standards:
  - 1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
  - 2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".
  - 3. UL and FM Compliance: Provide valves used in fire protection piping, which are UL-listed and FM approved.

PART 2 - PRODUCTS

2.1 VALVES:

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.
- C. Operators: Provide hand wheels, fastened to valve stem, for valves other than quarter-turn. Provide lever handle for quarter-turn valves, 5" and smaller, other than plug valves. Provide one wrench for every 10 plug valves. Provide gear operators for quarter-turn valves 6" and larger.
- D. Connections: Unless otherwise noted for a particular reason, any valve 2" and larger shall have flanges.

2.2 MANUFACTURERS: For all valves subject to compliance with requirements, provide valves of one of the following: Comply with specific manufacture requirements listed for specific valves.

- A. Crane
- B. Keystone
- C. Powell
- D. Nibco/Scott
- E. Lunkenheimer
- F. Stockham
- G. Milwaukee
- H. Bray
- I. Apollo
- J. Grinnell
- K. Watts
- L. Norris
- M. Wallworth

All valves of a given type shall be of the same manufacturer.

2.3 HOT WATER HEATING:

A. Ball Valves:

1. Steel piping 3" and Smaller: 400 psig WOG @ 350°F, bronze construction, threaded ends, bubble tight mineral filled PTFE seat at 250 psig under water, hard, chrome plated brass or stainless steel full ported ball. Operate with flow in either direction. Lever or tee hand as required. Suitable for throttling and tight shut-off. Watts B-6000, B-6001 for domestic water, Apollo 70-100. Crane Hydro Gem 2190H Milwaukee, Jamesbury, Stockham. No other manufacturers approved.

B. Balancing Cocks:

1. 2" and Smaller: 175 psig WOG, cast iron body, square head, screwed ends, wrench operated, lubricated. Crane, Stockham.

- C. Balancing Valves: Bell and Gossett "Circuit Setter Plus", Armstrong "CB" or Flowset Accusetter CB circuit balancing valve with venturi and pressure taps. Unless specifically indicated, gate valves and butterfly valves may not be used as balancing valves.

2.4 MISCELLANEOUS VALVES AND SPECIALTIES:

- A. Air Vent Valves: Stockham B-64, 300 psi working pressure, 3/8" bronze, Crane No. 88 or ball valve.
- B. Gauge Valves; Ball valve with tee handle.
- C. Install valves with bonnets at least 45 degrees above the horizontal to ensure debris does not collect in bonnet.

PART 3 - INSTALLATION

3.1 VALVE INSTALLATION:

- A. Locate all valves in locations which will allow easy operation and facilitate maintenance.
- B. Install valves with stems horizontal or above.
- C. Provide chain operators for any valves located more than 8 feet above finished floor. This means double acting lever handles for quarter turn valves, or chain wheels for multi-turn valves. Arrange valves and set up chain length for proper operation.
- D. All branch lines which supply a specific area of the building (such as a toilet room) shall be valved near the main so that each area may be isolated from the system for repairs without having to shut down both men and women's restrooms, other areas, or the whole building.

END OF SECTION 221000

**SECTION 224100 - WATER DISTRIBUTION PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

**1.2 SUMMARY:**

- A. This Section specifies the water distribution piping system, including potable cold, hot, and recirculated hot water piping, fittings, and specialties within the building.
- B. Water Supply Systems:
  - 1. Domestic Water
- C. Domestic Water Equipment:
  - 1. Domestic Water Expansion Tank
- D. Related Sections:
  - 1. Separate sections in Division 22 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements, general duty valves, pipe insulation, domestic hot water heaters and plumbing fixtures and equipment.

**1.3 QUALITY ASSURANCE:**

- A. Manufacturer's Qualifications:
  - 1. Firms regularly engaged in the manufacture of plumbing piping products and equipment of types, materials and sizes required, whose products have been in service for not less than five years.
- B. Installer's Qualifications:
  - 1. Firm with at least three years history of successful experience on projects of similar nature.
  - 2. Licensed as a firm in the Contractor state of origin and in the State of Utah.
  - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
  - 4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

**1.4 SUBMITTALS:**

- A. Product Data: Submit manufacturer's technical literature indicating source, brand, type,

model, performance characteristics, installation instructions, etc. Color chart for finished surfaces and fixtures.

- B. Record Drawings: See Section 230000 - General Mechanical Requirements.
- C. Operation and Maintenance Information: Provide information for all equipment including a comprehensive system operating description. See Section 239950 - System Commissioning, Testing and Balancing.

1.5 REFERENCES:

- A. Codes and Standards: Comply with applicable sections, follow recommended practices.
  - 1. State Boiler and Pressure Vessel Regulations
  - 2. ASME Codes for Boilers and Pressure Vessels
  - 3. State and Local Plumbing Code
  - 4. State and Local Mechanical Code
  - 5. State and Local Building Code
  - 6. ASHRAE/ASPE Handbooks
  - 7. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards".
  - 8. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps".
  - 9. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Store pipe in a manner to prevent sagging and bending.

1.7 SEQUENCING AND SCHEDULING:

- A. Coordinate the installation of pipe sleeves for foundation wall and floor penetrations.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

- A. Domestic Water Pipe: (except below slab/grade)
  - 1. Pipe Sizes 4" and Smaller: Copper tubing. Conform to ASTM B88, Type L, hard temper, copper tube; ASME B16.22 streamlined pattern wrought-copper fittings, with soldered joints using 95-5 tin antimony solder or non-lead bearing solders such as "Silvabrite."

2.2 VALVES:

- A. Ball, check, and drain valves are specified in Section 221000 - Valves.

**2.3 PIPING SPECIALTIES:**

**A. Strainers: (3" and smaller):**

1. Watts No. 777, WWP 250 psi at 210°F, cast bronze body, threaded, solid retainer cap, 20 mesh stainless steel screen (except 3" to have 3/64" perforated screen).
2. Approved Manufacturer:
  - a. Watts Series 777.

**2.4 DOMESTIC WATER EXPANSION TANKS:**

- A. Extent of Work: Tanks as indicated on drawings, clarify size and model, provide related piping valves, concrete pad or overhead suspension, line to drain, relief valve downstream of PRV's. Change air side to local water system static pressure.
- B. Expansion Tanks: Factory built unit pressurized diaphragm type, ASME stamped for 125 psig working pressure. Steel tank with neoprene diaphragm and polypropylene liner for nonmetallic isolation of water from steel. Fit tank with air charging valve and threaded water connection. NSF approved.
- C. Approved Manufacturers:
  1. Amtrol "ST" Series
  2. Bell and Gossett
  3. Taco.
- D. Installation: Install complete. Provide shut-off valves to system and to drain.

**PART 3 - EXECUTION**

**3.1 EXAMINATION:**

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation.
- C. Do not proceed until the unsatisfactory conditions have been corrected.

**3.2 JOINING PIPES AND FITTINGS:**

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.
- B. Galvanized Steel Threaded: Seal threaded joints with Teflon tape and pipe dope per manufacturers' installation techniques. Tighten to manufacturers specifications and test for leaks.
- C. PVC Pipe: Joining and installation of PVC distribution pipe and fittings shall conform to ASTM D2855. Install in continuous "V" channel support system.

**3.3 PIPING INSTALLATION:**

- A. Refer to the separate Division 22 section: General pipes and fittings, for general piping installation instructions.
- B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.
- C. Install piping level with no pitch.
- D. Install incidental.

**3.4 INSTALLATION OF VALVES:**

- A. Installation requirements for general duty valves are specified in Section 221000.
- B. Valves: Install in locations shown on drawings. Provide isolation valves for branch lines and service to all equipment, shown or not.
- C. Check Valves: Install swing check valves on discharge side of each pump, and elsewhere as indicated.

**3.5 EQUIPMENT CONNECTIONS:**

- A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code.

**3.6 FIELD QUALITY CONTROL:**

- A. Inspections:
  - 1. Do not enclose, cover, or put water distribution piping system into operation until it has been inspected and approved by the authority having jurisdiction.
  - 2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
  - 3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
  - 4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
  - 5. Re-inspection: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for reinspection by the plumbing official.
  - 6. Reports: Prepare inspection reports, signed by the plumbing official.
- B. Test all water distribution piping systems for leaks and defects. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

- C. Leave all water distribution piping uncovered and unconcealed until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
- D. Cap the piping system and subject to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to stand for a period of 4 hours. Leaks and loss in test pressure constitute defects which must be repaired.
- E. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
- F. Prepare reports for all tests and required corrective action.

**3.8 ADJUSTING AND CLEANING:**

**A. Cleaning and Disinfecting:**

- 1. Purge all water distribution piping systems.
- 2. Follow AWWA guidelines. Thoroughly sterilize the entire domestic water system with a solution containing not more than 50 parts per million of available chlorine. Introduce the chlorinating materials into the system in a manner approved by the Owner's representative. Allow the sterilization solution to remain in the system for a period of 24 hours, during which time, open and close all valves and faucets several times. After sterilization, flush the solution from the system with clean water until the residual chlorine content is not greater than 0.2 parts per million. Water system will not be accepted until a negative bacteriological test is made on water taken from the system. Repeat dosing as necessary until such negative test is accomplished.

**B. Reports:**

- 1. Prepare reports for all purging and disinfecting activities.

**3.9 INSTRUCTION OF OWNER'S PERSONNEL:** Participate in specified instruction. See Section 230000 - General Mechanical Requirements.

END OF SECTION 224100

SECTION 224200 - DRAINAGE AND VENT SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and General provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY:

- A. This Section specifies building sanitary and vent, storm drainage, including drains and drainage specialties.
- B. Related Sections:
  - 1. Separate sections in Division 02 specify foundation drainage, under duct drainage, storm sewage systems, sanitary sewage systems and trenching and backfilling. Provide a complete transition between work components.
  - 2. Separate sections in Division 07 specify flashing and sheet metal and joint sealers.
  - 3. Division 23 General Mechanical Requirements section applies to the work of this section.
  - 4. Separate sections of Division 22 specify Basic Piping Materials and Methods, Hangers and Supports, Expansion Compensation, piping system identification materials and requirements, pipe insulation, and plumbing equipment.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications:
  - 1. Firms regularly engaged in the manufacture of plumbing piping products and equipment of types, materials and sizes required, whose products have been in service for not less than five years.
- B. Installer's Qualifications:
  - 1. Firm with at least three years history of successful experience on projects of similar nature.
  - 2. Licensed as a firm in the Contractor state of origin and in the State of Utah.
  - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
  - 4. Employ workmen on the project who carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturers' technical literature indicating source, brand, type, model, performance characteristics, installation instructions, etc. Color chart for finished surfaces and fixtures.



- B. Record Drawings: See Section 23.
- C. Operation and Maintenance Information: Provide information for all equipment including a comprehensive system operating description. See Section 23.

1.5 REFERENCES:

- A. Codes and Standards: Comply with applicable sections, follow recommended practices.
  - 1. State Boiler and Pressure Vessel Regulations
  - 2. ASME Codes for Boilers and Pressure Vessels
  - 3. State and Local Plumbing Code
  - 4. State and Local Mechanical Code
  - 5. State and Local Building Code
  - 6. ASHRAE/ASPE Handbooks
  - 7. HI Compliance: Design, manufacture, and install plumbing pumps in accordance with HI "Hydraulic Institute Standards."
  - 8. UL Compliance: Design, manufacture, and install plumbing pumps in accordance with UL 778 "Motor Operated Water Pumps."
  - 9. UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.6 SEQUENCING AND SCHEDULING:

- A. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.
- B. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.
- C. Coordinate with installation of sanitary and storm sewer systems as necessary to interface building drains with drainage piping systems.

PART 2 - PRODUCTS

2.1 WASTE, DRAIN AND VENT SYSTEMS:

- A. Sanitary Soil Drain, Waste and Vent Piping: (Above Grade Only)
  - 1. Piping and Fittings: Schedule 40 PVC pipe and fittings conforming to the requirements of ASTM D 2665. Pipe and fittings shall be produced domestically as supplied by Spears, or Charlotte Pipe and Fittings.

2.2 EQUIPMENT AND SYSTEM VENTS AND DRAINS:

- A. Piping:
  - 1. Piping on closed side of system to match primary system served.
  - 2. Open vent and drain piping of Schedule 40 PVC or Type K or L copper.
- B. Valves: Provide valves appropriate for duty.

1. Locate air vent valves accessibly mounted on wall, 5'-0" above floor, extended to drain.

C. Installation Notes:

1. Slope all drains at 1/4" per foot or more.
2. Provide complete condensate drain systems for all furnaces and cooling coils, etc., and for all equipment which has a need for such service. Terminate such drain systems near floor drains, floor sinks or other authorized point of discharge.

2.3 DRAINAGE PIPING SPECIALTIES:

A. Vent Flashing and Termination:

1. Vent pipes penetrating the roof shall be flashed and made watertight at the roof with sheet metal flashing. Vent pipes shall extend at least 12" above roof. Coordinate installation with detail on drawings and roofing contractor

- B. Traps: Equip each fixture and piece of equipment connecting to the drainage system with a trap. Place each trap as near to the fixture as possible and no fixture shall be double trapped.

PART 3 - EXECUTION

3.1 EXAMINATION:

- A. Verify all dimensions by field measurements. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify all existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.
- C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.
- D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.
- E. Do not proceed until unsatisfactory conditions have been corrected.

3.2 JOINING PIPES AND FITTINGS:

- A. Copper Tubing: Solder joints in accordance with the procedures specified in ANSI B9.1.
- B. PVC Piping: Make solvent weld joints utilizing ASTM approved primers and glues per the piping manufacturers recommendations.

3.3 INSTALLATION:

- A. Refer to the separate Division 22 section: Basic Piping Materials and Methods, for

general piping installation instructions.

- B. Install supports and anchors in accordance with Division 23 General Mechanical Materials and Methods section "Supports and Anchors."
- C. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.
- D. Make changes in direction for drainage and vent piping using appropriate 45-degree wyes, half-wyes, or long sweep quarter, sixth, eighth, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Do not make a change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.
- E. Install building drain pitched down at minimum slope of 1/4" per foot (2 percent), unless noted otherwise and approved by the authority having jurisdiction.
- F. Extend new building drain piping to existing and connect.

#### 3.4 INSTALLATION OF PIPING SPECIALTIES:

- A. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
  - 1. As required by plumbing code;
  - 2. At each change in direction of piping greater than 45 degrees;
  - 3. At minimum intervals of 50' for piping 4" and smaller and 100' for larger piping;
  - 4. At the base of each vertical soil or waste stack.
- B. Cleanout Covers: Install floor and wall cleanout cover for concealed piping, types as indicated.
- C. Vent Flashing Sleeves: Install on stacks passing through roof, secure over stack flashing in accordance with manufacturer's instructions.
- D. Vent Cap: Install on all vents terminating through the sidewall. Secure to vent.

#### 3.5 CONNECTIONS:

- A. Piping Runouts to Fixtures: Provide drainage and vent piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.
- B. Locate piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

#### 3.6 FIELD QUALITY CONTROL:

A. Inspections:

1. Do not enclose or cover drainage and vent piping system or put into operation until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
3. Rough-in Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
4. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.
5. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
6. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test:

1. Test for leaks and defects all new drainage and vent piping systems. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, that has been covered or concealed before it has been tested and approved.
3. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
4. Prepare reports for all tests and required corrective action.

C. Surface Drainage Test: Restroom floors and all other floors with floor drains where there will be water or where water may get on floor shall be tested with water to make sure floors are watertight and there are no places where water stands.

3.8 ADJUSTING AND CLEANING:

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.9 PROTECTION:

- A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.
- B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 224200

SECTION 224400 - PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23, "Basic Mechanical Materials and Methods" sections apply to work of this section.

1.2 SUMMARY:

- A. This Section specifies plumbing fixtures. The types of fixtures specified includes the following:
  - 1. Electric Water Coolers w/ bottle filler
  - 2. Classroom Sink
  - 3. Emergency Eye Wash
  - 4. Cleanouts
  - 5. Mixing Valve

1.3 SUBMITTALS:

- A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified.
- B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with fixtures installed in countertops and cabinets. Furnish templates.
- C. Color Charts: Submit manufacturer's standard color charts for fixture colors.
- D. Maintenance Data: Include data in Maintenance Manual specified in Division 01 and Section 231950.

1.4 REFERENCES:

- A. Codes and Standards:
  - 1. ANSI Standards A117.1: "Specifications for Making Buildings and Facilities Accessible To and Usable By Physically Handicapped People."
  - 2. ADA: Americans with Disability Act.
  - 3. International Plumbing Code.

1.5 DELIVERY, STORAGE, AND HANDLING:

- A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommend temperatures to prevent damage.

- B. Store fixtures and Trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture on trim.

1.6 SEQUENCE AND SCHEDULING:

- A. Schedule rough-in installations with the installation of other building components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer uniformity shall be as specified in Section 230000, General Mechanical Requirements under Project Options.

2.2 FIXTURES AND TRIM: The model numbers listed below have been carefully selected to help bidders in the submittal process of selecting fixtures and trim. The completeness and accuracy of these numbers must be verified during the bidding process. Any discrepancies between the model numbers and the fixture, or trim descriptions noted by a manufacturer during the bidding process will be reported to the Architect / Engineer for clarification. Clarifications will be made a part of the contract through an addendum only. The contractor is responsible for reporting any clarifications before the bid date as required in this specification.

A. Electric Water Coolers:

1. (P-1) ADA Compliant Fixture Single Level)

- a. Wall-hung with bottle filler, mounted at height noted on architectural drawings, self-contained, front and side pressure operator with cast brass bubbler, air cooled, 7.8 gal. per hour capacity (minimum), with 90° ambient air water entering at 80° and leaving at 50°, stainless steel top, cabinet of stainless steel. Five year warranty, 120 volt, 60 cycle, 1 phase power.

(1) Approved Manufacturers:

- (a) Elkay No. LZS8WSLK
- (b) Oasis
- (c) Sunroc

2. (P-1) Supplies with Stops

- a. Chrome plated quarter turn cast brass angle stop, brass stem, gasketed seat, flexible chrome plated copper riser, chrome plated escutcheon, compression type connections.

b. Approved Manufacturers:

- (1) Brass Craft
- (2) Eastman
- (3) McGuire

3. (P-1) P-Trap

- a. PVC P-trap as recommended by electric water cooler manufacturer.
  - b. Approved Manufacturers:
    - (1) McGuire
    - (2) Frost
    - (3) Jameco
    - (4) Sanitary Dash
- B. Sinks:
- 1. (P-2) Classroom Sink, Single Bowl
    - a. Single compartment with integral backsplash, wall mounted, 14" x 10" x 5-1/2" deep inside dimensions of bowl, 20 gauge type 304 stainless steel, 3 faucet holes on 4" centers on backsplash.
    - b. Approved Manufacturers:
      - (1) Advance Tabco 7-PS-70
      - (2) Equal by others
  - 2. (P-2) Faucet:
    - a. Backsplash mounted, 6-1/4" high rigid gooseneck spout, non-aerated spout, 4" wing handles, supplies on 4" centers.
    - b. Approved Manufacturers:
      - (1) Chicago Faucet No. W4W-DB6AE1-317ABCP
      - (2) T & S Brass
      - (3) Advance Tabco
  - 3. (P-2) Supplies and Stops:
    - a. Chrome plated quarter turn cast brass angle stop, brass stem, gasketed seat, flexible chrome plated copper riser, chrome plated escutcheon, compression type connections.
    - b. Approved manufacturers:
      - (1) Brass Craft
      - (2) Eastman
      - (3) McGuire
  - 4. (P-2) Outlet Fitting and Tailpiece:
    - a. Chrome plated 17 gauge cast brass.
    - b. Approved Manufacturers:
      - (1) Elkay No. LK-53
      - (2) Just
  - 5. (P-2) Strainer:
    - a. Basket strainer, stainless steel, stainless steel basket, neoprene stopper, locking shell, tailpiece. Provide offset type where required to maintain

- b. ADA clearances.  
Approved Manufacturers:
  - (1) Jameco
  - (2) Sanitary Dash No. SS3000W
  - (3) McGuire
  - (4) Elkay
  - (5) Just
  
- C. Emergency Eyewash:
  - 1. (P-3) Fixture:
    - a. Wall mounted eye/face wash with green ABS plastic 11" bowl. 3.7 gpm flow control, chrome-plated brass ball valve with stainless steel ball and stem, tail piece, trap and strainer.
    - b. Manufacturers:
      - (1) Haws Model 7260BT-7270BT
  
- D. Mixing Valve (MV):
  - 1. Bronze body, stainless steel spring, graduated dial with setpoint indication, element overtravel protection, integral check valves.
  - 2. Approved Manufacturers:
    - a. Conbraco 34B Series.
    - b. Watts.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION:

- A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.
- C. Examine floors, floors, and cabinets for suitable conditions where fixtures are to be installed.
- D. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 INSTALLATION:

- A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.
- B. Comply with the installation requirements of ANSI A117.1 and Public Law 90-480 with



respect to plumbing fixtures for the physically handicapped.

- C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.
- D. Install a stop valve in an accessible location in the water connection to each fixture.
- E. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork.
- F. Seal fixtures to walls and floors using silicone sealant. Match sealant color to fixture color.

**3.3 FIELD QUALITY CONTROL:**

- A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, the retest. Also test for rigidity of fixtures hung on carriers, flush valves, etc.
- B. Inspect each installed unit for damage. Replace damaged fixtures.

**3.4 ADJUSTING:**

- A. Adjust water pressure at drinking fountains, faucets and flush valves to provide proper flow stream.
- B. Replace washers of leaking or dripping faucets and stops.

**3.5 CLEANING:**

- A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

**3.6 PROTECTION:**

- A. Provide protective covering for installed fixtures and trim.
- B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by the Owner.

END OF SECTION 224400

## SECTION 224450 - DOMESTIC WATER HEATERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, Division 01, etc., apply to the work of this section.
- B. Other Division 23 to the extent applicable apply to the work of this section.

#### 1.2 EXTENT OF THE WORK

- A. Provide gas fired domestic hot water heaters as scheduled and detailed.
- B. Provide all supporting installation with water piping and valves, relief valves, drains, etc., all required for a complete installation.

#### 1.3 SUBMITTALS

- A. Product Data: Submit information for each water heater and related material and equipment. Include dimensional data. Verify adequate clearance and support service before submitting data.

#### 1.4 REFERENCES

- A. Codes and Standards:
  - 1. Energy Code for commercial and high-rise buildings. (ASHRAE 90.1-2010 Chapter 4). Building Service Systems and Equipment.
  - 2. Comply with efficiencies and heat loss requirements of this code.
  - 3. Utah Plumbing Code, current adopted edition with amendments.

### PART 2 - PRODUCTS

#### 2.1 ELECTRIC STORAGE TYPE WATER HEATER: (30 gallon, 2,500 Watt input maximum)

- A. General: Capacity as scheduled on drawings.
- B. Product: Glass lined steel tank, high watt copper heating element, aluminum anode with stainless steel core, tamper resistant brass drain valve, top mounted T & P valve, 4,500 watt heating capacity with 30 gallon storage tank. Ashrae 90.1 compliant for thermal efficiency and standby losses. Install with heat traps on inlet and outlet.
- C. Manufacturer: Subject to compliance furnish water heater of one of the following:
  - 1. A. O. Smith EJCT-30
  - 2. American

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install complete. Place water heater in drain pan, connect piping with isolation and bypass valving, install relief valves and relief extension, connect to electric service as recommended by manufacturer. Seismically restrain water heater to structure as noted on the drawings.

**END OF SECTION 224450**

230000 GENERAL MECHANICAL REQUIREMENTS  
230005 DEMOLITION  
230600 GENERAL PIPES AND FITTINGS  
231400 MECHANICAL SUPPORTING DEVICES  
231700 MOTORS, DRIVES AND ELECTRICAL REQUIREMENTS  
231900 MECHANICAL IDENTIFICATION  
231950 OPERATION AND MAINTENANCE MANUALS  
232500 MECHANICAL INSULATION  
236500 REFRIGERATION PIPING AND EQUIPMENT  
238900 DUCTWORK  
229100 DUCTWORK ACCESSORIES  
239400 AIR OUTLETS AND INLETS  
239550 MECHANICAL CONTROL SYSTEMS  
239650 ELECTRICAL CONTROL SYSTEMS  
239700 DDC CONTROL SYSTEMS  
239950 SYSTEM COMMISSIONING, TESTING AND BALANCING

# HEATING VENTILATING & AIR CONDITIONING

division **23**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

**SECTION 230000 - GENERAL MECHANICAL REQUIREMENTS**

**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 work of this section.
  - 1. Sections of other Divisions which relate to mechanical work apply to the work of this section. See various Sections on sitework, underfloor work, structural work, finish materials, etc.
- B. Related Sections: Refer to "Electrical Requirements for Mechanical Equipment" Section in Division 23 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section.

**1.2 SUMMARY:** This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements of Division 01.

- A. This Division does not define, nor is it limited by, trade jurisdictions. All work described herein is a part of the General Contract and is required of the Contractor regardless.

**1.3 DESCRIPTION OF PROJECT:** The mechanical work described in these mechanical specifications is for a project located in Ogden, Utah. Design weather conditions are: 95° db, 62° wb, and winter 3°F. Altitude readings, unless otherwise noted, are for an elevation of 4,300 feet above sea level. Make adjustment to manufacturer's performance data as needed.

**1.4 CODES AND PERMITS, AUTHORITIES HAVING JURISDICTION:**

- A. Perform the mechanical work in strict accordance with the applicable provisions of the various codes ordinances and adoptions pertaining to the project location in effect on the date of invitation for bids. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications govern.
- B. Hold and save the Owner and Architect/Engineer free and harmless from liability of any nature or kind arising from failure to comply with codes and ordinances.
- C. Secure and pay for permits necessary for the prosecution of the work under this contract. Contractor to pay all fees and include connection fees related to utility hookups. Include all sewer connection fees verifying current rate with Santa Clara City prior to bid.
- D. Reference Standards:

American Welding Society  
International Mechanical Code/State Code  
International Building Code/State Code

SMACNA Duct Design Standards  
Local/State Plumbing Code  
Locally enforced NFPA Codes  
Local Fuel Utility Regulations  
Local Power Utility Regulations  
American Gas Association  
ASME Codes for Pressure Vessels and Piping  
ANSI B31.1 Piping

- E. Final inspection by the Architect/Engineer will not be made nor Certificate of Substantial Completion issued until certificates of acceptability from the Authorities having jurisdiction are delivered.

1.5 DEFINITION OF PLANS AND SPECIFICATIONS: The mechanical drawings at reduced scale show the general arrangement of piping, ductwork, equipment, etc., and shall be followed as closely as the actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as part of the work insofar as these drawings furnish the Contractor with information relating to design and construction of the building. Architectural drawings shall take precedence over mechanical drawings. Request clarification and participate in resolution in the event of conflict.

- A. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and arrange the work accordingly, providing such extensions, fittings, valves and accessories to meet the conditions as may be required. Some small scale work is not shown such as control conduit and piping, incidental piping, specialties. Provide as directed by note or specification.
- B. Examine the actual construction site prior to bidding and obtain an understanding of the conditions under which the work will be performed. No allowances will be made for failure to make such examination.
- C. During construction, verify the dimensions governing the mechanical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings. Examine adjoining work on which mechanical work is dependent for perfect efficiency, and report any work of other trades which must be corrected. No waiver of responsibility for defective work shall be claimed nor allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 26 for rough-in requirements.

1.7 MECHANICAL INSTALLATIONS:

- A. Coordinate mechanical equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements.

- C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate the cutting and patching of building components to accommodate installation of mechanical equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, existing structures and other installations.
- J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- K. Where mechanical work penetrates other trade work such as gypboard walls, etc., penetration shall be neatly cut and walls shall be filled and patched.

1.8 ACCESSIBILITY:

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.
- C. Establish required clearance to all installation features involving operation and maintenance. Respect manufacturers recommendations for access and clearance.
- D. Access Doors - General: All items of mechanical equipment which may require adjustment, maintenance, replacement or which control a system function shall be made readily accessible to personnel operating the building.
  - 1. Provide access doors in all ductwork or plenums as required to maintain fire dampers, fire smoke dampers, equipment, controls or other elements of the system. Doors shall conform to SMACNA standards unless otherwise detailed or specified.
  - 2. Provide access doors in floors, walls, ceiling and partitions to valves, cleanouts, chases, dampers, etc., and to access doors in ductwork requiring the same. Access doors shall be all-steel construction equivalent to "Milcor" by Inland

Ryerson in a style approved by the Owner's Representative. Doors shall be 24" x 24", or as needed, with screwdriver latches.

- 1.9 CHANGE ORDERS: See General Conditions.
- 1.10 ALTERNATIVE CONSTRUCTION/SUBSTITUTION: These documents outline a way in which the Owner may be delivered a functional and reliable facility. Drawings and specifications describe reasonable engineering practice for the Contractor to follow.
- A. Coordination between trades may result in periodic needs to adjust the installation from that indicated, but in no case shall the intended function be compromised.
  - B. The Contractor may perceive some work methods which differ from those specified which could save time and effort. These may be presented to the Architect with a breakdown of possible cost savings for review. Implement only with authorization.
  - C. Materials substitutions will generally be covered in a review process prior to bidding. After bidding, substitutions shall be proposed only on the basis of definitive cost accounting and implemented only with authorization.
- 1.11 CUTTING AND PATCHING:
- A. Lay out the project where new work is involved ahead of time, providing sleeves and blockouts, and have work specifically formed, poured and framed to accommodate mechanical installations. Cut and patch only as needed.
  - B. Refer to the Division 01 Section: CUTTING AND PATCHING for general requirements for cutting and patching.
  - C. Refer to Division 26 Section: BASIC ELECTRICAL REQUIREMENTS for requirements for cutting and patching electrical equipment, components, and materials.
  - D. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
  - E. Arrange for repairs required to restore other and any work damaged as a result of mechanical installations.
  - F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
  - G. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
    - 1. Uncover Work to provide for installation of ill-timed Work;
    - 2. Remove and replace defective Work;
    - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
    - 4. Remove samples of installed Work as specified for testing;
    - 5. Install equipment and materials in existing structures.
  - H. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
  - I. Cut, remove and legally dispose of selected mechanical equipment, components, and



materials as indicated, including, but not limited to removal of mechanical piping and other mechanical items made obsolete by the new Work.

- J. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

1.12 SUBMITTALS: Submittal of shop drawings, product data, and samples will be accepted only from the Contractor to the Architect. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed. Document each transmittal and sign and stamp the submittal indicating that it has been reviewed and is in compliance with the criteria of the project, any exceptions being clearly noted.

- A. Shop Drawings: As soon as possible after the contract is awarded, submit to the Architect, four (4) copies of the descriptive literature covering all equipment and materials to be used in the installation of mechanical systems for this project. Written confirmation of acceptable review by the Owner's Representative shall be obtained before ordering, purchasing, acquiring or installing any such equipment or materials for the project.

1. Prepare the submittals in an orderly manner after the order of this specification, contained in a three-ring loose-leaf binder(s) with an identification tab for each item or group of related items. Submitted literature shall clearly indicate performance, quality, utility requirements, dimensions, connection points and other information pertinent to effective review.
2. Equipment must fit into the available space with allowance for operation, maintenance, etc. The Contractor shall take full responsibility for space and utility requirements for equipment installed.
3. Factory-wired equipment shall include shop drawings of all internal wiring to be furnished with unit.
4. Review of the Architect/Engineer is for general conformance of the submitted equipment of the project specification; in no way does such approval relieve Contractor of his obligation to furnish equipment and materials that comply in detail to the specification, nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions which may affect his work.

- B. Record Drawings: During the course of construction, maintain a set of drawings, specifications, change orders, shop drawings, addenda, etc., for reference and upon which all deviations from the original layout are recorded. Turn these marked-up documents over to the Architect/Engineer at the conclusion of the work so that the original tracings can be revised. If the Contractor fails to mark up the prints, reimburse the Architect/Engineer for time required to do so.

1.13 OPERATION AND MAINTENANCE TRAINING:

- A. Instruction Of Owner's Personnel: At a time prior to Owner making use of a device or system, and in general after testing and balance work for a building or major system is complete, prepare, schedule and conduct a series of training sessions for Owner's operating and supervisory personnel. Instructions shall cover each device and system with emphasis on understanding of the purpose and function, the maintenance requirements and the proper adjustment and operating technique.
- B. Instruct building operating staff in operation and maintenance of mechanical systems utilizing Operation and Maintenance Manual when so doing.
- C. Contractor to video tape instruction sessions, and give video tape to owner.

- D. Minimum instruction periods shall be as follows:
    - 1. Mechanical - four hours, total.
    - 2. Temperature Control - four hours, total. Programming help as needed.
  - E. Initial instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made.
  - F. None of these instructional periods shall overlap another.
  - G. Vendors for each piece of equipment controls, etc., shall participate along with the Contractor(s).
- 1.14 **GUARANTEE/WARRANTY:** The following guarantee is a part of this specification and is binding on the part of the Contractor and his assigns:
- A. "Contractor guarantees that this installation is in accordance with the terms of the Contract and is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance. See also the General Conditions of these specifications. Failed equipment in the repair or replacement shall be guaranteed for one full year from the date of recommission."
  - B. Compile and assemble the warranties required by Division 23 into a separated set of vinyl covered, insert sheets, tabulated and indexed for each reference, included in the O & M Manual.
  - C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.
  - D. Mechanical systems and equipment shall not be considered for substantial completion and initiation of warranty until they have performed in service continuously without malfunction for at least thirty (30) working days.
- 1.15 **TESTS AND CERTIFICATIONS:** Make all tests required by code or specification in the presence of a representative of the Owner, with tests recorded and certified by the Contractor and Representative. Involve local authorities where required.
- 1.16 **PERMITS, FEES, LICENSES:** Refer to General Conditions. See Paragraph 1.04.
- 1.17 **CEILING SPACE COORDINATION:** Carefully coordinate ceiling cavity space with all trades; however, installation of mechanical equipment within the ceiling cavity space allocation, in the event of conflict, shall be in the following order: plumbing waste lines; supply, return and exhaust ductwork; domestic hot and cold water; fire protection; control conduit. Respect clearances required for lights, electrical conduits, protected structure, etc. All spaces above any and all ceilings shall be defined and considered as return air plenum space.
- 1.18 **MECHANICAL COORDINATION DRAWINGS:** For the entire building including all floor spaces, mechanical rooms, congested areas, or areas of great detail, prepare and submit a set of coordination drawings showing major elements, components and systems of mechanical equipment and materials in relationship with other building components (structure, fire sprinkler,

electrical, etc.). Prepare drawings to an accurate scale of 1/4" - 1-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction. Prepare floor plans, reflected ceiling plans, elevations, sections and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

- A. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement. To include structure, ductwork, piping, fire protection, large electrical conduit, recessed lights, etc.
- B. Pipe expansion loops.
- C. Numbered valve location diagrams.
- D. Manifold piping for multiple equipment units.
- E. General floor plan layouts with ductwork, piping, lighting, structure, etc.
- F. Use drawings to coordinate all affected trades. Do not work without coordinated drawings.

## **PART 2 - GENERAL MECHANICAL MATERIALS AND METHODS**

### **2.1 QUALITY OF MATERIALS AND EQUIPMENT:**

- A. All equipment and materials shall be new, and shall be the standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment, and shall be the manufacturer's latest design. Specific equipment shown in schedules on drawings and specified herein is to be the basis for the Contractor's bid. Provisions for substitute equipment are outlined in the General Conditions. All materials shall be produced by manufacturing plants located in the United States of America.
- B. Furnish and install all major items of equipment specified in the equipment schedules on the drawings complete with all accessories normally supplied with catalog items listed, and all other accessories necessary for a complete and satisfactory installation.

### **2.2 PROTECTION OF MATERIALS AND EQUIPMENT:**

- A. Close pipe and duct openings with caps or plugs to prevent lodging of dirt or trash during the course of installation. Cover equipment tightly and protect against dirt, water and chemical or mechanical injury. Plumbing fixtures intended for the final installation shall not be used by the construction forces. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly and deliver in a factory dock condition for the Owner's acceptance. Make damage and defects developing before acceptance of the work good at Contractor's expense.
- B. Do not make temporary use of project equipment, new or existing, during construction without the consent of the owner. **DO NOT USE SYSTEM FOR TEMPORARY HEAT!!**

**2.3 QUALIFICATIONS OF WORKMEN:**

- A. All mechanics shall be capable journeymen, skilled in the work assigned to them. Apprentices may be used with appropriate direction.
- B. Employ no unskilled persons in the work which he is given to do; execute all work in a skillful and workmanlike manner. All persons employed upon this work shall be competent, faithful, orderly and satisfactory to the Owner. Should the Owner's Representative deem anyone employed on the work incompetent or unfit for his duties, and so certify, Contractor shall dismiss him and he shall not be again employed upon the work without permission of the Owner's Representative.
- C. All welders involved in welding of pressure piping systems shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Written verification of successful test completion shall be submitted to Architect prior to initiating work.

**2.4 FOREMAN:** Dedicate and designate a full-time general mechanical foreman to the Owner's Representative to be consistently available on site during the life of the project for consultation. Do not replace this individual without prior approval from the Owner's Representative.

**2.5 USE OF COMMON VENDORS:** Regardless of subcontract delegations, coordinate purchasing between trades so that equipment and materials of similar nature come from a single vendor, i.e., all package HVAC terminal units shall be common source. Valves, variable volume boxes, speed drives, etc., the same. Do not burden the Owner with multiple brands of similar equipment unless so directed.

**2.6 ROOF/WALL/FLOOR PENETRATIONS - FLASHINGS:**

- A. Install sleeves through the floor into "dry rooms" flush with the floor, caulked and sealed. Into wet rooms, extend piping to create 1" dam. Use Schedule 40 galvanized steel pipe for all pipe sleeves.
- B. Let pipe sleeves allow for movement of the pipe due to expansion and contraction, yet to include seismic restraint.
- C. Flashings:
  - 1. Flash all pipes penetrating the roof. Provide required flashing components.
  - 2. Clamp roof drains to roof membrane, follow manufacturer's directions.
  - 3. Flash and counter-flash other piping penetrating the roof. See drawings or Architect/Engineer for additional detail.
  - 4. Make all ductwork penetrating the roof watertight with flashings, counter-flashing and sealant. Provide curbs for all such openings.

**2.7 EXCAVATING AND BACKFILLING (GENERAL):**

- A. Provide all excavation, trenching and backfilling for Division 23000 underground duct and piping work. Excavation and backfilling shall comply with applicable paragraphs of Division 02. Tamp bottoms of trenches hard and, for soil and waste piping, grade to secure uniform fall of 1/4" per foot, or as noted. Excavate bell holes for hub and spigot pipes so that pipe rests on solid ground for its entire length. Lay sewer and water pipe in separate trenches, except where otherwise noted, as detailed.

- B. After work has been tested, inspected and approved by the Owner's Representative and/or State/Local Inspector, and prior to backfilling, clean the excavation of all rubbish, and clean backfill materials free of trash. Place backfill in horizontal layers not exceeding 12" in thickness, properly moistened. Mechanically compact each layer with suitable equipment to a dry density of not less than 95 percent as determined by the Modified AASHTO Test T-180. See Division 02 for additional requirements.
  - 1. Provide adequate shoring to safeguard workers from cave-ins for all excavations.
  - 2. In areas where General Contractor has finish grade work to do, Mechanical Contractor shall backfill and compact to 8" below finish grade. Where no finish surface work is to be done, Mechanical Contractor shall backfill and compact to and match adjacent undisturbed surface with allowance for settling, etc.
  - 3. Protect from damage all existing underground utilities or utility tunnels indicated on the contract drawings (or field located for the Contractor by the Owner prior to excavation operations). Any damage to identified existing utilities or utility tunnels shall be repaired by the Contractor at no cost to the Owner.

**2.8 HANGERS AND SUPPORTS (GENERAL):**

- A. Provide hangers and/or supports for all equipment, piping and ductwork. Primary information is contained in these specifications and on the drawings.
- B. Provide hangers and supports to correlate with seismic restraint and vibration isolation.

**2.9 MANUFACTURER'S DIRECTIONS:** Install all equipment in strict accordance with directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, report such conflicts to the Architect who shall direct adjustments as deemed necessary and desirable.

**2.10 LUBRICATION:** Lubricate equipment at startup. Then, provide all lubricants for the operation of all equipment until acceptance by the Owner. The Contractor is held responsible for all damage to equipment and bearings while the equipment is being operated by him consequent to pre-acceptance operation.

**2.11 ELECTRICAL WIRING AND CONTROL:**

- A. In general, motor starters, related motor starter equipment and power wiring indicated on the electrical drawings and control diagrams are to be furnished and installed under Division 260000 of this Specification. Items of electrical control equipment specifically mentioned to be furnished by the Division 23000 either in these specifications or on the electrical or mechanical drawings, shall be furnished and mounted by this Contractor and shall be connected under and as required by this Division 23000 and Division 260000 of these specifications.
- B. Refer to the control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the contractor.
- C. Division must be fully coordinated with Division 260000 to insure that all required components of the work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of coordination.
- D. Where the detailed electrical work is not shown on the electrical drawings, the

Mechanical Contractor shall furnish, install and wire or have prewired all specified and necessary controls for air handling equipment specified for this project. The objective of this paragraph is to make sure a complete operating system is obtained at no additional cost to the Owner for field wiring required related to the equipment.

2.12 FLUSHING AND DRAINING OF SYSTEMS/CLEANING OF PIPING AND DUCTS: Fill, clean and flush and sterilize where appropriate, all water piping systems with water and drain these systems before they are placed in operation. Blow out all other piping systems with compressed air or nitrogen to remove foreign materials that may have been left or deposited in the piping system during its erection. Duct systems shall have all debris removed and fans shall be run to blow out all dust and foreign matter before grilles, outlets or mixing boxes are installed and connected.

A. Damp wipe all ductwork on installation, cap open ducts, cover fan inlets, vacuum fan plenums and related installation before starting fans. Run fans only with filters in place.

2.13 JOBSITE CLEANUP:

A. Keep site clean during progress of work.

B. At the conclusion of work, clean all installation thoroughly.

1. Leave equipment in a factory dock condition. Correct any damage and touch up or repaint if necessary.
2. Remove all debris from site.

END OF SECTION 230000

SECTION 230005 - DEMOLITION

PART I - GENERAL

1.1 SECTION INCLUDES:

- A. Remove existing general, mechanical and plumbing installations in the remodel area which is no longer useful to the functions of the building.
- B. Maintain existing installations which continue in service or are adapted to new service.
- C. Adapt existing installation to new conditions, ie., remove and reinstall piping which must be offset or revised to accommodate new installation, layouts, etc.

1.2 REFERENCES:

- A. Respond to General Conditions, Supplemental General Conditions, Division 1, etc.

1.3 PROJECT/SITE CONDITIONS:

Work areas are in the existing general building areas, mechanical rooms and chase spaces. Ductwork and piping exists throughout the building. The building's utilities are to be restored to service. Be familiar with site conditions and be careful in the work.

1.4 SCHEDULING AND SEQUENCING:

Program and schedule any required interruptions of primary utility service with the General Contractor.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL PIPING AND EQUIPMENT:

Remove all mechanical piping, related insulation, equipment and accessories in the remodeled areas rendered obsolete by this work. The contractor shall field coordinate existing work versus new and remove all piping, equipment, and accessories not required by new work to remain. Dispose of removed material offsite in an approved manner.

3.2 HVAC DUCTWORK AND EQUIPMENT:

Remove all HVAC ductwork, related insulation, equipment and accessories in the remodeled areas rendered obsolete by this work. The contractor shall field coordinate existing work versus new and remove all ductwork, equipment, and accessories not required by new work to remain. Dispose of removed material offsite in an approved manner.

3.2 CONTROLS:

Remove existing control system rendered obsolete by this work. Remove all control devices, and associated electrical wiring, control valves and dampers, cap or terminate wiring in existing junction boxes or at existing mains. Adapt existing control devices to new equipment providing all accessories required.

END OF SECTION 230005



SECTION 230600 - GENERAL PIPES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. This section is Division 23 General Pipes and Fittings section, and is part of each Division 23 section making reference to pipes and pipe fittings specified herein.
- C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. This section is generic in that it describes material and installation required by several other sections of this specification.
- B. Types of pipes and pipe fittings specified in this section include the following:
  - 1. Steel Piping
  - 2. Galvanized Steel Piping
  - 3. Cross Linked Polyethylene
  - 4. Copper Piping
  - 5. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications:
  - 1. Firm with at least three years history of successful experience on projects of similar nature.
  - 2. Licensed as a firm in the contractor state of origin and in the State of Utah.
  - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.
  - 4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping

system.

- B. Brazing Certifications: Submit reports as required for piping work.
- C. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 01.

#### 1.5 REFERENCES:

- A. Codes And Standards:
  - 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
  - 2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
  - 3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

#### 1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling, as required, to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

### PART 2 - PRODUCTS

#### 2.1 GENERAL:

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. Use United States (domestic) manufactured pipe only. Do not use foreign made pipe.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable. Use domestic manufactured fittings only. Do not use foreign manufactured fittings.

**2.2 STEEL PIPES AND PIPE FITTINGS:**

- A. Black Steel Pipe: Seamless or ERW, ASTM A 53.
- B. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- C. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- D. Galvanized Steel Pipe: ASTM A 53.
- E. Galvanized Seamless Steel Pipe: ASTM A 53.
- F. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- G. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- H. Dielectric Unions: 175 psig WSP at 250°F. Equal to Walter Vallet Company V-line insulating coupling.
- I. Threaded Pipe Plugs: ANSI B16.14.
- J. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
  - 1. Material Group: Group 1.1.
  - 2. End Connections: Buttwelding.
  - 3. Facings: Raised-face.
  - 4. Steel Pipe Flanges for Waterworks Service: AWWA C207.
- K. Forged-Steel and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- L. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- M. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

**2.3 COPPER TUBE AND FITTINGS:**

- A. Copper Tube: ASTM B 88; Type K, L (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated. Do not use Type M for pressure piping.
- B. DWV Copper Tube: ASTM B 306.
- C. ACR Copper Tube: ASTM B 280.
- D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

- E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- H. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- I. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

#### 2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use **no lead** bearing solders in domestic water applications.
  - 1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
  - 2. Silver-Lead Solder: ASTM B 32, Grade 96TS.
- B. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.
  - 1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
- D. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
  - 1. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following
    - a. Fernco, Inc.
- E. Strainers:
  - 1. Y pattern, self-cleaning, line size. Armstrong, Bailey, Crane, Fisher, Metraflex, Mueller, Sarco, Strong, or Yarway.
    - a. Iron Body, Screwed Ends 2" and Smaller: 250 psig at 425°F, screen mesh to suit service.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and

couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

1. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.
- C. All piping in mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.
- D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.
- E. Arrange piping to maintain head room and keep passageways clear.
- F. Provide unions at connections to equipment and elsewhere as required to facilitate the maintenance.
- G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.
- H. Erect all piping to insure proper draining. Domestic water, chilled water, and heating water shall slope down a minimum of 1" per 40 feet towards the drains. Pitch standpipes down to fire department connections a minimum of 1" per 40 feet. Slope soil, waste, vent, and roof drain lines in accordance with requirements of Uniform Plumbing Code.
- I. On horizontal straight runs of pipe, use eccentric reducers with straight side on top for water piping.
- J. Electrical Equipment Spaces: Do not run piping in or through transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.
- K. Anytime lines are broken or disconnected they shall be capped immediately after flushing. If rocks or other foreign materials are found in the system after it has been closed, the Contractor shall stand the expense of their removal.

### 3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- D. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

### 3.3 CLEANING, FLUSHING, INSPECTING:

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
  - 1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Flush, treat and clean portions of the heating water system modified under this contract in accordance with Sections chemical treatment. Certify by signature of Contractor and Owner's Representative.

### 3.4 PIPING TESTS:

- A. General: Provide temporary equipment for testing, including pump and gages. Test the piping system before insulation is installed, and wherever feasible remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
  - 1. Required test period is 2 hours.
  - 2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are lower Class or pressure rating.
  - 3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
  - 4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- B. Notifications: At least 10 days prior to commencement of required testing, notice shall be submitted for review. Tests shall be made prior to painting insulating or covering of any joints and shall be in accordance with ANSI Code for Pressure Piping.

- C. Inspections: Contractor to visually inspect piping while under hydrostatic pressure. Copies of inspection shall be submitted for review.
- D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- E. Drain test water from piping systems after testing and repair work has been completed.
- F. Test pressure piping in accordance with ANSI B31.
- G. If test procedures in other sections differ from the above, comply with more stringent requirements.

END OF SECTION 230600

SECTION 231400 – MECHANICAL SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. This section is Division 23 Mechanical Supporting Devices section, and is part of each Division 23 section making reference to supports and anchors specified herein.
- C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 23 sections.
- B. Types of supports and anchors specified in this section include the following:
  - 1. Horizontal-Piping Hangers and Supports.
  - 2. Vertical-Piping Clamps.
  - 3. Hanger-Rod Attachments.
  - 4. Building Attachments and In-Beds.
  - 5. Saddles and Shields.
  - 6. Miscellaneous Materials.
  - 7. Roof Equipment Supports.
  - 8. Anchors.
  - 9. Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.
- D. Relate this section to Section 232400 regarding seismic and vibration control.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
- B. Shop Drawings:
  - 1. Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of



assembly of components.

- C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

## 1.5 REFERENCES:

### A. Codes and Standards:

1. Code Compliance: Comply with applicable building, mechanical and plumbing codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
3. MSS Standard Compliance:
  - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
  - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
  - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
  - d. Terminology used in this section is defined in MSS SP-90.

## PART 2 - PRODUCTS

### 2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

- A. General: Except as otherwise indicated, provide factory- fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevises Hangers: MSS Type 1. (For suspension of non-insulated or insulated stationary pipe lines; 1/2" to 30".
- C. Steel Double Bolt Pipe Clamps: MSS Type 3. (For suspension of pipe requiring up to 4" of insulation and where flexibility of clamp is desirable; 3/4" to 24".
- D. Steel Pipe Clamps: MSS Type 4. (For suspension of cold pipe lines or hot lines where little or no insulation is required; 1/2" to 24".
- E. Pipe Hangers: MSS Type 5. (For suspension of piping when off-center closure allowing installation of hanger before erection of piping is desired; 1/2" to 4".
- F. Adjustable Swivel Pipe Rings: MSS Type 6. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".

- G. Adjustable Steel Band Hangers: MSS Type 7. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".
- H. Adjustable Band Hangers: MSS Type 9. (For suspension of non-insulated stationary pipe lines; 1/2" to 8".
- I. Adjustable Swivel Rings, Band Type: MSS Type 10. (For suspension of non-insulated stationary pipe lines; 3/8" to 8".
- J. Split Pipe Rings: MSS Type 11. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".
- K. Extension Split Pipe Clamps: MSS Type 12. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".
- L. U-Bolts: MSS Type 24. (For support of heavy loads; 1/2" to 30".
- M. Clips: MSS Type 26. (For support of uninsulated piping not subject to expansion or contraction.
- N. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange. (To support pipe from floor stanchion, using floor flange to secure stanchion to floor 4" to 36".
- O. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange. (To Type 36 except U-bolt provided for retaining pipe.

## 2.2 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8. (For support and steadying of pipe risers; 3/4" to 20". Also supports pipe covering or insulation.
- C. Four-Bolt Riser Clamps: MSS Type 42. (When longer ends are required for riser clamps.

## 2.3 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13. (For adjustment up to 6" for heavy loads.
- C. Steel Clevises: MSS Type 14. (For use on high temperature piping installations.

- D. Swivel Turnbuckles: MSS Type 15. (For use with split pipe rings, MSS type 11.
- E. Malleable Iron Sockets: MSS Type 16. (For attaching hanger rod to various types of building attachments.

2.4 BUILDING ATTACHMENTS AND IN-BEDS:

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18. (For upper attachment for suspending pipe hangers from concrete ceiling.
- C. Top Beam C-Clamp: MSS Type 19. (Use under roof installations with bar joist construction, for attachment to top flange of structural shape.
- D. Side Beam or Channel Clamps: MSS Type 20. (For attachment to bottom flange of beams, channels, or angles.
- E. Center Beam Clamps: MSS Type 21. (For attachment to center of bottom flange of beams.
- F. Welded Beam Attachments: MSS Type 22. (For attachment to bottom of beams where loads are considerable and rod sizes are large.
- G. C-Clamps: MS Type 23. (For attachment to structural shapes.
- H. Top Beam Clamps: MSS Type 25. (For attachment to top of beams when hanger rod is required tangent to edge of flange.
- I. Side Beam Clamps: MSS Type 27. (For attachment to bottom of steel I-beams.
- J. Steel Beam Clamps with Eye Nut: MSS Type 28. (Same as Type 28 with link extensions.
- K. Linked Steel Clamps with Eye Nut: MSS Type 29. (Same as Type 28 with link extensions.
- L. Malleable Beam Clamps: MSS Type 30. (For attachment to structural steel.
- M. Steel Brackets: One of the following for indicated loading:
  - 1. Light Duty: MSS Type 31, to 570 pounds.
  - 2. Medium Duty: MSS Type 32, to 1,500 pounds.
  - 3. Heavy Duty: MSS Type 33, to 3,000 pounds.
- N. Side Beam Brackets: MSS Type 34. (For use on sides of steel or wooden beams.
- O. Plate Lugs: MSS Type 57. (For attachment to steel beams where flexibility at the beam is desired.

- P. Horizontal Travelers: MSS Type 58. (For supporting piping systems subject to linear horizontal movements where head room is limited.

**2.5 SADDLES AND SHIELDS:**

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; see section Mechanical Insulation for void fill requirements. Use for roller supports and on all pipes 10" and larger.
- C. Protection Shields: See section Mechanical Insulation.
- D. Thermal Hanger Shields: See section Mechanical Insulation.
- E. Manufacturer; Subject to compliance with requirements, provide thermal hanger shields of one of the following:
  - 1. Elcen Metal Products Co.
  - 2. Pipe Shields, Inc.

**2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:**

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
  - 1. Kin-Line, Inc.
  - 2. Fee & Mason Mfg. Co.; Div. Figgie International
  - 3. ITT Grinnel Corp.
  - 4. B-line
  - 5. Unistrut

**2.7 HIGH HUMIDITY AREAS:** Use cadmium plated or galvanized hangers, attachments, rods, nuts, bolts and other accessories in boiler rooms or other high humidity areas.

**2.8 OUTSIDE AREAS:** Use galvanized hangers, attachments, rods, nuts, bolts, and other accessories for all outside areas.

**2.9 MISCELLANEOUS MATERIALS:**

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2. Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Use Embeco grout for non-shrink applications.
- D. Heavy Duty Steel Trapezes: Fabricate from factory built channel (Unistrut) system and use factory fasteners for channel steel shapes, selected for loads required; weld steel in accordance with AWS standards.

- E. Pipe Guides: Provide factory-fabricated guides, of cast semi- steel or heavy fabricated steel, consisting of bolted two- section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

#### 3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

#### 3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to rigidly support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

- C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by isolating with foam rubber covering or 30 mil insulating tape.
- D. Provisions for Movement:
  - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
  - 2. Install supports within 2 feet of non-vertical flex connectors.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Insulated Piping: Do not allow hangers to come in contact with pipe where pipe is specified to be insulated.
- H. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- I. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install galvanized steel protective shields. Install calcium silicate blocks (12" long minimum) at support points.
- J. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

### 3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

### 3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend a minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 231400

**SECTION 231700 - MOTORS, DRIVES AND ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

**1.2 SUMMARY:**

- A. This section specifies the basic requirements for motors and drives furnished by this Division and for electrical components which are an integral part of packaged mechanical equipment. Package components include, but are not limited to factory installed motors, starters, and disconnect switches, etc.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are noted within these documents.

**1.3 QUALITY ASSURANCE:**

- A. Provide electrical components and materials which are UL labeled.
- B. Provide variable speed drives which conform to the latest standard of the following:
  - 1. IEEE - Institute of Electrical and Electronic Engineers.
  - 2. NEC - National Electrical Code.
  - 3. NEMA - National Electrical Manufacturers Association.
  - 4. Provide complete packaged unit(s) which are listed and carry the label of at least one of the following:
    - a. UL - Underwriters Laboratory
    - b. ETL - ETL Testing Laboratories, Inc.
    - c. CSA - Canadian Standards Association

**1.4 SUBMITTALS:**

- A. Submit complete product and application information for variable speed drives as follows:
  - 1. Provide multiple sets of drawings of system (VFD) being supplied, in strict compliance with the specifications. Include, as a minimum:
    - a. General arrangement of each unit showing size and incoming and outgoing conduit locations.
    - b. Schematic.
    - c. Connection diagram, sufficient to install drive system.
  - 2. Provide each unit with four owner/maintenance manuals which shall include:



- a. Vendor information of equipment being supplied.
  - b. Connection information.
  - c. Start-up procedure.
  - d. Fault reset instruction.
  - e. Wiring diagrams (power and control).
  - f. Parts list.
  - g. Test results.
  - h. Harmonic voltage distortion on line with unit off.
  - i. Harmonic voltage distortion with unit on line.
- B. Submit product data for motors, belts, drives, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections. Verify project electrical characteristics with submittal. Confirm suitability for altitude, maintaining full nameplate rating plus service factor. Include this data in maintenance manual in accordance with Division 23195 "Operation and Maintenance Manuals".

#### 1.5 REFERENCES:

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standards 250: Enclosures for Electrical Equipment.
- D. NEMA Standards KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

#### 1.6 WARRANTY:

- A. General: Furnish a written warranty consisting of the following:
  1. Warranty parts and labor for five years after substantial completion.

### PART 2 - PRODUCTS

#### 2.1 MOTORS:

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
  1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
  2. Motor sizes large enough so that the driven load will not require the motor to operate in the service factor range.
  3. Single speed motors of the permanent split capacitor type. (PSC)
  4. Temperature Rating: Minimum rate for 40°C environment with maximum 90°C temperature rise for continuous duty at full load (Class H Insulation for altitude, Class B leads allowed).

5. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.
6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors, 1.0 for TEFC motors.
7. Motor Construction: NEMA Standard MG 1, general Purpose, continuous duty, design "B", except "C" where required for high starting torque.
8. Frames: NEMA Standard No. 48 or 54; T-frame, use driven equipment manufacturer's standards to suit specific application.
9. Bearings:
  - a. Ball or roller bearings with inner and outer shaft seals;
  - b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
  - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;
  - d. For fractional horsepower, light duty motors, sleeve type bearings are permitted;
10. Enclosure Type:
  - a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
  - b. Weather protected type I for outdoor use, Type II where not housed;
11. Overload Protection: built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
12. Noise Rating: "Quiet"
13. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112.
14. Nameplate: indicate the full identification of manufacturer. ratings, characteristics, construction, special features and similar information.
15. Acceptable Manufacturers: Baldor, General Electric, Reliance, U.S. Motors, Siemens, Toshiba, Washington Fieldstek, Allen-Bradley, AD Smith.

END OF SECTION 231700

SECTION 231900 - MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods sections apply to work of this section.
- C. Cross reference Division 09 for basic painting requirements. Use this section to identify extent of painting for pipes, ducts, etc. and color coded identification.

1.2 SUMMARY:

- A. All plumbing, heating, air conditioning, automatic temperature control equipment (excluding thermostats and relays), and distribution systems shall be labeled. Include all fire damper, fire/smoke damper and smoke dampers. Electrical switches and starters for mechanical equipment shall also be labeled.

PART 2 - GENERAL MECHANICAL MATERIALS AND METHODS

2.1 VALVE, AND PIPE IDENTIFICATION:

A. Valve Tagging:

All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The Contractor shall furnish and install approved brass tags for all designated items, with numbers and letters on the tags corresponding to those on the charts and diagrams.

1. Valve Identification:

- a. All valves, regardless of size, shall have brass tags at least 1" by 3" in size and 0.051 inches thick. Legend on tag shall use engraved lettering at least 1/8" high. Each valve on the drawing shall be identified separately, and valve tags shall match the drawing identification.
- b. Valve tags shall include the following minimum information:
  - (1) Plan Identification
  - (2) Normal Position
  - (3) Duty
  - (4) Area Served
  - (5) Valve Type
- c. Tags shall be securely fastened to valves with steel rings or brass jack chain, in a manner to permit easy reading. Do not attach to valve wheel or the handle.

2. A chart of all valves shall be furnished as part of O & M Manual by the Contractor. Charts shall indicate the following items:
  - a. Valve identification number  
Location  
Service or purpose  
Normal position
  - b. One chart to be mounted in a frame with clear lexan front, and secured on a wall in the equipment room(s), or in a location as otherwise directed by the Architect.
  - c. Another chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at tope of plastic closure to allow for affixing approximately an 811 length of nickel plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plant Company, New Haven, Connecticut or equal.
  
3. Sample Identification Chart is as follows:

**VALVE IDENTIFICATION CHART**

Number	Description	Location*	Normal Position
1.	Cold Water Supply to Water Heater	Mech Rm #121	Open
2.	Hot Water Supply from Water Heater	Room #212	Open
3.	Heating Hot Water Balancing Above	Room #412	On Valve

\* The above room numbers shall be the room numbers actually used. DO NOT USE ARCHITECTURAL ROOM NUMBERS ON PLANS. Use institution actual assigned room numbers.

**B. Pipe Identification:**

1. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
  - a. Adjacent to each valve
  - b. At every point of entry and exit where piping passes through a wall or floor.
  - c. On each riser and junction.
  - d. A maximum of every 50 feet on long continuous lines fully exposed to view. Less spacing if one cannot see one code from the adjacent.
  - e. Adjacent to all special fittings or devices (regulating valves, etc.)
  - f. Connection to equipment.
  
2. Apply markers so they can be read from floor. Labels and markers shall be of the self-sticking, all temperature, permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.
  
3. Identifying lettering shall be painted or stenciled on duct or pipe. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2" high for duct and larger

piping 3" or more, 1" high for 1-1/4" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.

4. Arrows to indicate direction of flow shall be painted in the same color as the lettering. The arrow shall point away from the lettering. On duct and large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
5. Pipe color coding shall be uniform throughout. Background colors shall be as follows:
  - a. Yellow: Dangerous Materials (high pressure steam, natural gas, condensate, high pressure refrigerant, high voltage, etc.)
  - b. Red: Fire Protection Equipment (fire sprinkler water, fire protection water).
  - c. Bright Blue: Protective Materials (filtered water).
  - d. Green: Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)

6. Piping and duct shall be identified with the following colors:

Abbreviation & Medium	Identifying Lettering	Pipe or Duct Color
Lettering Color		
Water:		
Domestic Cold Water	DCW	Green
Domestic Hot Water	DHW	Yellow
Domestic Hot Water Return	DHWR	Yellow
Heating Water Supply	HWS	Yellow
Heating Water Return	HWR	Yellow
Drain	Black	Black
Air:		
Supply Air	Supply Air	Painted on Duct
Exhaust Air	Exhaust Air.	or insulation with
Return Air	Return Air	arrow indicating
Outside Air	Outside Air.	direction of flow
		Black

7. Markers shall be installed in strict accordance with manufacturer's instructions.
  - a. On chalky and loose insulation, soft, porous, fiberfilled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
  - b. On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used for 360 color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or bonding tape.
8. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance. If stenciling is used,

letter heights, background colors, banding and arrows shall be as specified above. Submit samples before proceeding with work.

END OF SECTION 231900

**SECTION 231950 - OPERATION AND MAINTENANCE MANUALS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to work of this section.
- B. Division 23 General Mechanical Requirements sections apply to work of this section.

**1.2 SUMMARY:**

- A. Furnish four sets of bound operation and maintenance manuals. Manuals shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

**1.3 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:**

- A. General:
  - 1. The "Operating and Maintenance Manual" is a bound compilation of drawings and data that the owner requires for each building or project. These manuals, complete with drawings and data, shall be furnished to the Owner.
  - 2. The mechanical contractor has overall responsibility to obtain the necessary data and compile the data as set forth in this specification, including items or equipment purchased by the Owner and delivered to the contractor for installation.
  - 3. Make all information legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.
- B. Purpose: The Operating and Maintenance Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.

**PART 2 - MATERIALS AND METHODS**

- 2.1 **PAGE SIZE:** All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 16 x 11 inches) folded to 8-1/2 x 11 inch.
- 2.2 **DRAWINGS:** All drawings larger than 8-1/2" x 11" shall be folded and inserted in individual 8-1/2" x 11" manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.
- 2.3 **BINDERS:** Binders shall be 3 ring type for sheet size 8-1/2 x 11 inches. Binders shall contain a

place for cover and backbone inserts.

- A. Place the following information on the front cover and backbone:
1. "Operation and Maintenance Manual".
  2. Project Name.
  3. Building name.
  4. Architect's name.
  5. Engineer's name.
  6. General Contractor's name.
  7. Mechanical Contractor's name.
  8. Items 5 through 7 need not be printed on the backbone.

#### 2.4 CONTENTS AND INDEXING:

- A. Manuals shall contain descriptions of the building systems in sufficient detail to adequately indicate the type of systems installed and the basic details of their operation.
- B. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.
- C. Operation and Maintenance Manuals shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:
1. Copy of purchase order change (if any).
  2. Outline drawings, special construction details, as built electrical wiring and control diagrams for all major and supplementary systems.
  3. Manufacturers test or calculated performance data and certified test curves.
  4. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.
  5. Manufacturers brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by him, shall also be included.
  6. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.
  7. Include a Table of Contents. The contents shall be divided with tabbed index dividers into the following suggested parts:
  8. Part I Building and System Descriptions
  9. Part II Purchased Equipment Data
  10. Part III Test Reports.
  11. Part IV Start-Up and Operation
  12. Part V Preventative Maintenance Recommendations
  13. A copy of all testing, adjusting and balancing reports.
  14. Wiring diagrams, marked with model and size and plan symbol.
  15. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained.

END OF SECTION 231950



SECTION 232500 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.
- B. Division 23, Section 230000 - General Mechanical Requirements applies to work of this section.

1.2 SUMMARY:

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules as required by the current Model Energy Code, and by requirements of this section. Use no asbestos in this work. Include restorations of insulations of damaged work including repair of damaged existing insulation due to new work.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Piping Systems Insulation:
    - a. Fiberglass.
    - b. Flexible Unicellular.
  - 2. Ductwork System Insulation:
    - a. Fiberglass.
    - b. Rigid flexible wrap.
  - 3. Equipment Insulation:
    - a. Fiberglass.
- C. Refer to Division 23 section "Mechanical Supporting Devices" for protection saddles, protection shields, and thermal hanger shields.
- D. Refer to Division 23 section "Ductwork" for duct linings.
- E. Refer to Division 23 section "System Identification" for installation of identification devices for piping, ductwork, and equipment.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets,

coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide mechanical insulation materials of one of the following (except as noted):
  - 1. Armstrong World Industries, Inc.
  - 2. Babcock and Wilcox Co., Insulating Products Div.
  - 3. CertainTeed Corp.
  - 4. Knauf Fiber Glass GmbH.
  - 5. Manville Products Corp.
  - 6. Owens-Corning Fiberglass Corp.
  - 7. Pittsburgh Corning Corp.

2.2 PIPING INSULATION MATERIALS:

- A. Preformed Fiberglass Piping Insulation: ASTM C 547. Class 1 for use to 450°F (230°C); Class 2 for use to 650°F (345°C); Class 3 for use to 1200°F (650°C).
- B. Flexible, Unicellular Pipe Insulation: Closed-cell elastomeric, preformed, with heat fusion or contact cement joining system. Insulation may be compressed but not stretched. By Armaflex II or Rubatex.
- C. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of Armstrong Wb Armaflex Finish.
- D. Jackets for Piping Insulation: All purpose (ASJ) fire retardant jacket, ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

- E. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- F. Encase exterior fittings and insulation with aluminum jacket with weather-proof construction.
- G. Encase suction diffusers in a removable/replaceable insulating box.
- H. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- I. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- J. Insulation Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- K. Thermal Hanger Shields: constructed of 360 degrees insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation.
  - 1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
    - a. Elcen Metal Products Co.
    - b. Pipe Shields, Inc.

### 2.3 DUCTWORK INSULATION MATERIALS:

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1 - 400°F (204°C); Class 2 - 400°F (204°C); Class 3 - 850°F (454°C); Class 4 - 1000°F (538°C); Class 5 - 1800°F (982°C); Class 1 - 10 lbs/ft<sup>3</sup>; Class 2, 3 and 4 - 12 lbs/ft<sup>3</sup>; class 5 - 20 lbs/ft<sup>3</sup>.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type 1 - resilient, flexible; Class B-1 - 0.65 lbs/ft<sup>3</sup>; Class B-2 - 0.75 lbs/ft<sup>3</sup>; Class B-3 - 01.0 lbs/ft<sup>3</sup>; Class B-4 - 1.5 lbs/ft<sup>3</sup>; Class B-5 - 2.0 lbs/ft<sup>3</sup>; Class B-6 - 3.0 lbs/ft<sup>3</sup>; Type II - flexible; Class F-1 - 4.5 lbs/ft<sup>3</sup>; Type III - semirigid; Class F-2 - 4.5 lbs/ft<sup>3</sup>.
- C. Calcium Silicate Duct Insulation: ASTM C553, Type I, block or preformed sections. Rated assembly for greasehood exhaust duct enclosure.
- D. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.
- E. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- F. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

### 2.4 PIPING SEALANT THROUGH WALLS:

- A. Sealant shall be a two-part foamed silicone elastomer equal to Dow Corning 3-6548 Silicone RTV foam or equivalent by 3M or "Spec Seal" by STI. Sealant shall be applied at any piping of pipe or duct penetration through fire or smoke walls to prevent air from passing through the opening.
- B. Sealant cell structure, foamed in place, shall be U.L. classified and shall meet the smoke development and fuel contribution ratings specified. Sealant shall be stable at extreme temperatures, and shall effectively confine such hazards as fire, smoke and gases.
- C. Sealant required at any fire/smoke wall penetration to be according to approved detail for each specific wall assembly. Contractor shall submit detail for engineer approval.

**2.5 FIRE/SMOKE ENCASEMENT:**

- A. Any and all PVC, PVDF, polypropylene, acid waste and vent and any other plastic piping located in return air plenums shall be encased in rated flame and smoke system. The encasement shall be equal to Firemaster "Plastic Pipe Fire Protection System." The enclosure shall meet all codes.

**2.6 PIPE JACKETING:**

- A. Provide and install jacketing for all insulated pipe exposed in mechanical rooms. This in addition to standard foil on Kraft jacketing (ASJ).
  - 1. Domestic water, heating water, other insulated piping.
    - a. PVC sheets, 0.030" thickness.
    - b. PVC formed fitting covers.
    - c. Solvent welded joints and seams.
    - d. (Provide for removal and expansion.)
- B. All joints and seams caulked and sealed water tight.
- C. Color of jacketing selected by Owner.

**PART 3 - EXECUTION**

**3.1 GENERAL:**

- A. Piping insulation shall be fiberglass one-piece preformed pipe insulation, class related to temperature, with all purpose (ASJ) fire retardant jacket, additional jacketing as noted.
- B. Fittings and valves shall be insulated and covered with preferred Zeston (PVC) covers.
- C. All cold water, chilled water, roof drains or any other lines upon which condensate moisture could form, shall have a vapor-proof jacket.
- D. Fire and smoke hazard for a complete insulation system shall not exceed:
  - 1. Flame spread - 25
  - 2. Fuel contribution - 50
  - 3. Smoke development - 50

- E. Hangers shall not contact pipe where pipe is specified to be insulated. Insulation shall run continuous through the pipe hanger.

**3.2 INSPECTION:**

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.3 PLUMBING PIPING SYSTEM INSULATION:**

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions strainers check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, fire protection piping, and pre-insulated equipment.

- B. Cold Piping:

- 1. Application Requirements: Insulate the following cold plumbing piping systems:

- a. Potable cold water piping.
    - b. Plumbing vents within 6 lineal feet of roof or wall outlet.

- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

- a. Fiberglass with all service jacket, self sealing lap:
    - b. 1" thickness, taped and sealed joints.

- C. Hot Piping:

- 1. Application Requirements: Insulate the following hot plumbing piping systems:

- a. Potable hot water piping.

- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

- a. Fiberglass with all service jacket, self-sealing lap: 1" thick for pipe sizes up to and including 6", 1-1/2" thick for pipe sizes over 6".

**3.4 HVAC PIPING SYSTEM INSULATION:**

- A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, and expansion joints.

- B. Hot Pressure Piping (to 250°F):

- 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 100 psi, water piping up to 200 degrees F).

- a. HVAC hot water supply and return piping, valves and fittings.
- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/4" through 4", 2" thick for pipe sizes over 5".
- C. Refrigerant Piping:
  - 1. Application Requirements: Insulate the following HVAC piping systems.
    - a. Refrigerant piping.
  - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
    - a. Closed cell elastomeric preferred insulation.
- D. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing. Use only impermeable insulations (foam glass). Cover with aluminum jacketing 0.02" minimum thickness.

### 3.5 DUCTWORK SYSTEM INSULATION:

- A. Insulation Not Required: Do not insulate lined ductwork, except as noted, or exposed to weather.
- B. Hot, Cold and Dual Temperature Ductwork:
  - 1. Application Requirements: Insulate the following ductwork:
    - a. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet. Insulate neck and bells of supply diffusers.
    - b. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet: except omit insulation on return ductwork located in return air ceiling plenums.
  - 2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    - a. Rigid fiberglass: Class 1, 1-1/2" thick, increase thickness to 2" in machine, fan and equipment rooms.
    - b. Flexible Fiberglass: Type 1, Class B-4, 1-1/2" thick, application limited to concealed locations.
- C. Duct Insulations:
  - 1. Wrap insulation snugly on the ductwork such that maximum thickness is maintained. Butt all circumferential joints and overlap longitudinal joints a minimum of 2". Adhere insulation with 4" strips of Insulation Bonding Adhesive, at 8" on center.

2. On circumferential joints, staple the 2" flange of the facing with 9/16" flare-door staples on 6" centers and taped with minimum 3" wide foil reinforcing Kraft tape. Tape all pin penetrations or punctures in the facing.

3.6 EQUIPMENT INSULATION:

A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:
2. Roof drain bodies.
3. Factory insulated surfaces do not need to be field insulated.

B. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:

1. Fiberglass: 2" thick for surfaces above 35°F (2°C) and 3" thick for surfaces 35°F (2°C) and lower.

3.7 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on all pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Provide neatly beveled edge at all terminations and interruptions of insulation.
- I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- J. Saddles and Shields:
  1. General: Except as otherwise indicated, provide protection saddles or thermal

hanger shields with protection shields under all piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and thermal shields for exact fit to mate with pipe insulation.

2. Protection Saddles: See section Supports and Anchors for saddle. Fill interior voids with segments of insulation matching adjoining insulation.
3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation. Use on pipes 1-1/4" and smaller. Use with thermal hanger shields for pipes 1-1/2" and larger.
4. Thermal Hanger Shields: High density calcium silicate encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation. Use on pipes 1-1/2" to 8".

### 3.8 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
- H. Corner Angles: Install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

### 3.9 INSTALLATION OF EQUIPMENT INSULATION:

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.



- E. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- F. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- G. Do not insulate over handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- H. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance: including metal vessel covers, fasteners, flanges, frames and accessories.

**3.9 PROTECTION AND REPLACEMENT:**

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during construction period to avoid damage and deterioration.

END OF SECTION 232500

**SECTION 236500 - REFRIGERATION PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 GENERAL MECHANICAL REQUIREMENTS**

- A. All pertinent sections of Section 230000 General Mechanical Requirements are a part of the work described in this section.
- B. All pertinent sections of Section 22 General Requirements for Plumbing and Piping are a part of the work described in this section.

**1.2 SUMMARY**

- A. This section specifies:
  - 1. Refrigeration piping systems and equipment for split type air conditioning systems.
  - 2. Piping, valves, specialties.

**1.3 STANDARDS**

- A. International Building Code/International Mechanical Code
- B. Local Codes and Ordinances
- C. State Pressure Vessel Regulations
- D. EPA Requirements.

**1.4 SHOP DRAWINGS/SUBMITTALS**

- A. Submit a list of all materials to be used indicating brand or source, type and service.
- B. Submit shop drawings for all equipment, valves and specialties, including shop drawing showing proposed pipe routing, sizing, valving, etc.

**1.5 CONTRACTOR QUALIFICATION**

- A. The Piping Contractor for this work shall be licensed as a firm in the Contractor state of origin and in the state of Utah.
- B. The Contractor shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
- C. All workmen employed in the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

**1.6 SCOPE OF THE WORK**

- A. Furnish and install all field fabricated refrigeration systems and related work to effect a complete installation.

- B. Provide and install complete refrigeration piping systems and equipment for split air conditioning systems as indicated in the Contract Documents and as specified in this section. Make systems fully operational.
- C. Piping, valves, specialties.
- D. Other work indicated on the drawings.

#### 1.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.
- B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.

#### 1.8 WARRANTIES See Section 23.

### PART 2 - MATERIALS AND METHODS

- 2.1 EQUIPMENT: All major items of refrigeration equipment shall be as specified in the equipment schedules on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.
- 2.2 PIPING MATERIALS: Piping materials shall be as follows unless otherwise indicated on the applicable contract drawing:
  - A. Pipe: "ACR" Type L, hard drawing, degreased, sealed at mill copper tubing, ASTM B88-62, cleaned and sealed at the mill. Pre-charged refrigerant lines shall not be used.
  - B. Fittings: Long radius, wrought copper type equal to Mueller Streamline, ASME B16.22.1963.
- 2.3 VALVES, SPECIALTIES, ETC.
  - A. Filter-Dryer: On lines smaller than 3/4" O.D. filter-dryer shall be a sealed type using male flare fittings. Size shall be full line size. Filter-dryer shall be Sporlan, Mueller or Alco.
  - B. Sight Glass: Shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.
  - C. Flexible Connection: Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for system working pressure.
- 2.4 REFRIGERANT AND LUBRICATING OIL: The Contractor furnish and install all of the refrigerant required to develop the system to its full rating, and in addition to the initial charge, he shall be required to provide, without cost to the Owner, all required refrigerant for the proper operation of the refrigeration apparatus during the first year's operation. The contractor shall be required to provide the initial charge of lubricating oil for all refrigeration apparatus and related equipment. Loss of refrigerant and oil during the first year of operation shall be made good at the contractor's

expense.

2.5 SPLIT HEAT PUMP UNITS (FCU-1 & 2 & HP-1)

- A. Extent of Work Provide split type heat pump units, complete in all components as indicated on the drawings.
- B. Outdoor Condensing Units: Outdoor mounted, air cooled unit with hermetic or rotary compressor, air cooled coil and propeller type cooling fan.
  - 1. Cabinet: Cabinet shall be constructed of galvanized steel and finished with a baked enamel painting process. Unit access panels shall be removable and shall provide full access to all internal components.
  - 2. Fans: Outdoor fans shall be direct-drive propeller type with totally enclosed single phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.
  - 3. Compressor: Compressor shall be fully hermetic or scroll type compressor equipped with a complete oil system, operating oil charge and motor. Motor shall be equipped with internal overloads which protect the compressor from overtemperature and overcurrent. Scroll type compressors shall also be equipped with high discharge gas temperature protection.
  - 4. Outdoor Coil: Coil shall be constructed of seamless copper tubes mechanically bonded to aluminum fins.
  - 5. Refrigeration Circuit: Refrigerant circuit components shall include brass service valves and port connections, schrader type fittings with brass caps, accumulator, pressure relief, and a full charge of refrigerant.
  - 6. Safeties: The condensing unit shall contain the following safety circuitry and components.
    - a. Time delay restart to prevent short cycling.
    - b. Auto restart on power failure.
    - c. High and low pressure switches.
    - d. High pressure relief.
    - e. Outdoor fan failure protection.
  - 7. Accessories: Provide the following accessories.
    - a. Filter Dryer.
    - b. Sight Glass.
    - c. Support Feet.
    - d. Low Ambient Kit
    - e. Flex connections by anaconda.
- C. Indoor Fan Unit: Indoor ceiling mounted direct expansion unit with forward curved fan, cooling / heating coil, micro-processor based controls, and condensate pump in one cabinet.
  - 1. Cabinet: Cabinet shall be heavy gauge galvanized steel with fan, coil, filter and control sections. Cabinet shall be thermally and acoustically insulated to improve performance.
  - 2. Fans: Fans shall be fabricated of high impact polystyrene and shall be forward curved design for quiet operation. Fan motor shall be open drip proof permanently lubricated ball bearing type with inherent overload protection. Fan motors shall be 3 speed.

3. Coil: Coil shall be constructed of aluminum fins seamlessly bonded to copper tubes with galvanized steel tube sheets. A full length drip pan with manufacturers condensate pump shall be provided.
4. Controls: Controls shall be microprocessor based and shall control space temperature, determine optimal fan speed, and run self-diagnostics. The unit shall provide the following minimum control functions.
  - a. Automatic reset function after power failure.
  - b. 24-hour timer cycle for system auto start/stop.
  - c. High discharge air temperature shutdown shall be provided.
  - d. Indoor coil freeze protection.
  - e. Wireless infrared remote control.
  - f. Automatic air sweep control to provide equal air distribution to all areas.
  - g. Dehumidification mode shall be provided.
  - h. Fan only operation.
  - i. A time delay shall prevent compressor short cycling.

D. Approved Manufacturers:

1. Mitsubishi
2. Fujitsu
3. Carrier

## PART 3 – EXECUTION

### 3.1 INSTALLATION OF HEAT PUMP (HP-1)

- A. General: Use best practices of the trade in all installation. Installation shall conform to the American Standard Code for Pressure Piping, ASME B31.5-1962, Refrigeration Piping. Installed piping shall not interfere with the operation and accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in a straight manner, free from traps, and shall be provided with capped or plugged ends, as it is erected, to prevent dirt from entering the system. The piping system shall be provided with isolating cushions, Unistrut P2600 Uni-Cushion at all hangers to prevent vibration and sound from being carried to the building structure.
- B. Slope of Refrigerant Lines: Slope suction lines down toward compressor 1" per 10 feet. Locate oil traps every 10 feet at all vertical rises against flow in suction lines. Suction line traps shall be standard one-piece traps.
- C. Cleanliness: All refrigerant lines and fittings shall be absolutely clean to avoid system operating difficulties and contamination. Use a good cleaning agent.
- D. Joints:
  1. Brazed joints: Tubing shall be cut square and burrs removed. Both inside of

- fittings and outside of tubing shall be well cleaned with steel wool, wire brush, or fine emery cloth before sweating.
2. An inert gas (such as oil pumped dry nitrogen) shall be continuously passed through the copper piping when brazing joints to prevent formation of copper oxide. Care shall be taken to prevent annealing of fittings and tubing when making connections. Joints shall be made with silver bearing brazing material.
- E. Vibration Isolation: Install condensing units on vibration isolation base noted on contract documents. Secure base securely to structure and secure condensing units securely to base. Install flexible connections just downstream of service valves and before sight glass and filter dryer.
- 3.2 TESTING OF REFRIGERATION PIPING SYSTEM: After the installation of the refrigeration piping system has been completed and before insulation is applied, all pipes shall be tested and proven tight for a period of 24 hours at a pressure of 300 pounds per square inch using oil pumped dry nitrogen.
- 3.3 EVACUATION AND CHARGING: After completion of the piping pressure test, the refrigeration systems shall be evacuated and dehydrated using a vacuum pump capable of producing at least 1 mm Hg absolute. The following procedure shall be followed unless otherwise noted:
- A. Connect an accurate high vacuum gauge, such as Stokes or Zimmeril gauge to the system.
  - B. Connect the vacuum pump to both the high and low side of the system. Leave the compressor suction and discharge service valves closed. Start the vacuum pump.
  - C. Keep ambient air temperatures above 60° during the evacuation process.
  - D. Operate the vacuum pump until the system is evacuated to 2.5 mg Hg absolute.
  - E. Break the system vacuum with oil pumped dry nitrogen. Open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm Hg absolute.
  - F. After the system has been double evacuated to 2.5 mm Hg absolute, close the vacuum pump suction valve and stop the pump. Allow the system to stand under a vacuum a minimum of 12 hours. If no noticeable rise in pressure has taken place after 12 hours, the system may be charged. This test shall be made in the presence of the Owner's representative.

END OF SECTION 236500

SECTION 238900 - DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 SUMMARY:

- A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork required for the project include the following:
  - 1. Round
  - 2. Rectangular
  - 3. Spiral
  - 4. Factory
- C. Exterior Insulation of metal ductwork is specified in other Division 23 sections, and is included as work of this section.
- D. Refer to other Division 23 sections for exterior insulation of metal ductwork; not work of this section.
- E. Refer to other Division 23 sections for ductwork accessories; not work of this section.
- F. Refer to other Division 23 sections for fans and rooftop units; not work of this section.
- G. Refer to other Division 23 sections for mechanical controls; not work of this section.
- H. Refer to other Division 23 sections for filters; not work of this section.
- I. Refer to other Division 23 sections for grilles and diffusers; not work of this section.
- J. Refer to other Division 23 sections for system commissioning, testing and balancing; not work of this section.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.

1. The installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

**1.4 SUBMITTALS:**

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.
- B. **Shop Drawings:** Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spacial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. **Record Drawings:** At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
- D. **Maintenance Data:** Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

**1.5 REFERENCES:**

- A. **Codes and Standards:**
  1. **SMACNA Standards:** Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
  2. **ASHRAE Standards:** Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
  3. **NFPA Compliance:** Comply with NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems".
  4. **International Building Code/ International Mechanical Code:** Comply with all sections pertaining to mechanical work.
- B. **Field Reference Manual:** Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

**1.6 DELIVERY, STORAGE, AND HANDLING:**

- A. **Protection:** Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. **Storage:** Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

**PART 2 - PRODUCTS**

**2.1 DUCTWORK - GENERAL:**



- A. Standards: All duct fabrications shall comply with standards and techniques detailed by SMACNA "Duct Construction Manuals" for the appropriate pressure class, and with the ASHRAE Handbook, 1988 edition, Chapter 1, Duct Construction
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; mill phosphatized for exposed locations.

## 2.2 FITTINGS AND FABRICATION:

- A. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° lateral and 45° elbows for branch take-off connections. Where 90° branches are indicated, provide conical type tees.
- B. Fittings: Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Fabricate elbows utilizing inside and outside radiuses with a center-line radius equal to associated duct width; or where fully radiused elbows are not possible, fabricate elbows with an inside square and outside radius and include turning vanes in the first 1/3 of elbow. Maintain duct width throughout turn on inside square and outside radiused elbows. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- C. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 section "Duct Accessories" for accessory requirements.
- D. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.
- E. Offset, transition, adapt ductwork to structural obstacles and work of other trades in a coordinated effort. Layout work to avoid conflict with piping, etc. With review of conditions, teardrop around conflicting piping, lights, etc., all at no added cost to the owner.

## 2.3 DUCT PRESSURE CLASSIFICATIONS:

- A. For all constant volume low pressure rooftop systems:
  - 1. Rectangular supply air and return air ductwork: Low pressure rectangular ductwork, 3" w.g.
  - 2. Branch round supply air ductwork runout from rectangular ductwork to diffuser: Low pressure round ductwork, 1" w.g.

## 2.4 LOW PRESSURE ROUND DUCTWORK: (1" SMACNA Pressure Class)

- A. Round type ductwork for use on low velocity supply systems (1200 fpm maximum), low pressure (0.75" maximum duct pressure), shall be fabricated on 26 gauge galvanized steel sheets with snap-lock longitudinal seams and crimped and beaded joints.
- B. All end joints shall have at least three screw fasteners and shall be wrapped airtight. Transverse and longitudinal seams shall be taped with "Hardcast TA". Snap lock longitudinal seams shall be seal with water based duct sealer **NO EXCEPTIONS**. Elbows and fittings shall provide smooth air flow patterns and have a neat appearance.

- C. Use factory fabricated elbows in lieu of the multi-sectional adjustable type.

**2.5 LOW PRESSURE RECTANGULAR DUCTWORK: (3" SMACNA Pressure Class)**

- A. Rectangular ductwork for use on supply systems up to 2" maximum duct static pressure and 2000 fpm maximum duct velocity shall be constructed of galvanized steel using construction for nominal 3" SMACNA rated systems. Seal all transverse and longitudinal joints with water based duct sealer NO EXCEPTIONS.
- B. Use radiused elbows, or square inside radiused outside elbows with single thickness turning vanes in the first 1/3 where space restrictions prohibit fully radiused elbows. Use 45° high efficiency tapping takeoffs with separate downstream balance dampers.
- C. Duct dimensions are inside clear. Increase for acoustical lining.
- D. For rectangular exhaust ducts, increase metal gauge by 2 (i.e. 20 to 18) for all sizes. Seal all joints.

**2.6 MEDIUM PRESSURE SPIRAL DUCTWORK**

- A. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam

Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

- B. Round Duct Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams. Mitered elbows shall be of at least 5 piece construction with R/D ratio of 1.5.

Diameter	Minimum Gauge
3" to 36"	20

**2.7 FACTORY DUCT:**

- A. Extent of Work: Provide factory duct at connections to air terminal units, at runouts to grilles and diffusers, at points of round to round flexible connections (see also "Flexible Connections") and at other locations indicated or required.
- B. Prohibited Material: Do not use single wire helix ducting with vinyl or plastic liner of any type.
- C. Factory Duct Non-corrosive Environments: Woven fiberglass fabric impregnated with vinyl or neoprene clamped in a continual helix of aluminum or cold rolled steel. U.L. listed for Class 1 duct, compliant with NFPA 90A and 90B, pressure rated to 12" w.g., equivalent to:

1. Non-insulated: Wiremold 57; Flexmaster Type N145
  2. Insulated: Flexmaster Type 4; Thermaflex M-KC
- D. Installation: Follow manufacturers instructions. Use stainless steel or nylon band clamping rings. In general, do not use lengths in excess of 1'-0". Do not make bends with factory duct, use hard elbows as indicated. Support duct to avoid droops and kinks. See details on the drawings.

## 2.8 MISCELLANEOUS DUCTWORK MATERIALS:

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Runout Fittings: Runout fittings shall be used to make round to rectangular duct connections. Use 45° time and a half square to round fittings. Provide with locking quadrant dampers where balance is involved. Provide with insulation guard where insulated duct is involved.
- C. Duct Sealing Compound: Duct sealing compound shall be 3M brand number EC-750, Duro-Dyne S-2 or Mon-Eco Industries 44-52. This material shall be used in making up duct joints or in water proofing, caulking plenums, etc.
- D. Acoustical Lining: Acoustical lining in ducts shall be 1" thick, 1-1/2 pound density, coated, flexible glass fiber type, set in adhesive and impaled on weld studs spaced not more than 12" on centers and secured with lock washers. Airstream surface faced with black coated matte. Acoustical lining shall completely line the ducts. Lining shall have a fire and smoke hazard rating not exceeding 20-50-50. Owens-Corning, Johns-Manville, Certainteed.
1. All joints, edges and/or surface breaks in the coating of the acoustical lining shall be pointed up to a smooth surface with adhesive.
- E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives and Duct Thermal Insulation".
- F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
- G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/ installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

## PART 3 - EXECUTION

### 3.1 INSPECTION:

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner

acceptable to Installer.

### 3.2 INSTALLATION OF METAL DUCTWORK:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
1. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All of these changes, however, must be approved and installed as directed at project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering.
- B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- D. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures. Maintain clearances above of and in front of electrical panels.
- E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.
1. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate, in accordance with requirements of Section "Firestopping".
- F. Ducts at Structural and Architectural Penetrations: Where ducts are shown connecting to or passing through concrete, gypsum board, masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2-1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron. Round high velocity ducts in vertical chases shall be supported with rolled angle rings. Close

openings between duct and structure.

- G. Cross Breaking: Rectangular sheet metal ducts shall be cross broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.
- H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- I. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.
  - 1. Related to final installation cleanliness, damp wipe all ductwork on installation. Cap open duct ends, cover fan inlets, vacuum fan plenums and related installation before starting fans. Run fans only with filters in place.

### 3.3 INSTALLATION OF DUCT LINER:

- A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.
  - 1. As indicated on the drawings, supply, return and exhaust air ductwork shall be lined with acoustical insulation.
  - 2. In all cases outside air ductwork shall be lined with 2' thick 1-1/2 lb. density acoustical lining unless indicated differently on drawings, ie. requiring Type 2 plenum.

### 3.4 INSTALLATION OF FLEXIBLE DUCTS:

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 1'-0" extended length. No elbows allowed.
- B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible".

### 3.5 HANGERS AND SUPPORTS:

- A. Support all ductwork in accordance with SMACNA standards.

3.6 SUPPORTING DAMPERS: Parallel and opposed blade motor operated dampers shall be supported by reinforcing the ductwork or sheet metal walls at the damper locations to carry the weight of the dampers and the force exerted on the dampers due to air pressure, or shall be supported independent of ductwork from the ceiling or floor, as conditions at the site determine.

3.7 DUCT SEALING: Seal all tranverse joints and longitudinal seams with approved sealer. Apply sealer to all joints in layers, look to achieve a final thickness of 1/32" over the entire joint.

3.8 AESTHETIC LAYOUTS: Contractor shall locate all diffusers, grilles and other exposed items in such a manner as to fit symmetrically in any grid system or other aesthetic architectural or lighting pattern. Refer to reflected ceiling plans and electrical lighting layouts for additional information. Provide duct offsets or extensions as required to make a proper installation.

- A. Close or cap all duct ends. Use auxiliary blower with air flow meter to establish a duct pressure equivalent to the duct pressure class. Inspect all joints in duct system and seal all identifiable leaks.

**3.9 FIELD QUALITY CONTROL:**

- A. Leakage Tests: After each duct system which is constructed for duct classes over 3" is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away) shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. Repair leaks and repeat tests until total leakage conforms with Chart of Figure 4-1, Seal Class A, Leakage Class 3 for round/oval, 6 for rectangular.

**3.10 EQUIPMENT CONNECTION:**

- A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

**3.11 ADJUSTING AND CLEANING:**

- A. Clean ductwork internally of dust and debris, as follows: Before the ceilings are installed, with filters in place, operate the fans at full capacity to blow out dirt and debris from ducts. If it is not practical to use the main supply blower for this test, the ducts may be blown out in sections by a portable fan.
- B. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- C. Balancing:
  - 1. Refer to Division 23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. However, the Sheet Metal Contractor shall participate fully in this work. Seal any leaks in ductwork that become apparent in balancing process.
  - 2. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor and his subcontractors shall make any changes necessary to obtain the specified conditions.

END OF SECTION 238900

SECTION 239100 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY:

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork accessories required for project include the following:
  - 1. Dampers.
    - a. Low pressure manual dampers.
  - 2. Turning vanes.
  - 3. Duct hardware.
  - 4. Flexible connections.
- C. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

1.5 REFERENCES:

- A. Codes and Standards:

1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Protection: Protect shop-fabricated and factory-fabricated accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store accessories inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 – PRODUCTS

2.1 MANUAL DAMPERS:

- A. Dampers for balance only where tight shutoff is not critical are to be furnished and installed by this Section.
  1. Exposed locations:
    - a. Honeywell D-640 (Rectangular), Honeywell D-690 (Round).
    - b. Ruskin CD-35 (Rectangular), Ruskin CDRS-25 (Round)
    - c. Johnson.

2.3 TURNING VANES: Turning vanes shall be single thickness blades with  $\frac{3}{4}$ " trailing edge. Blade spacing shall be per SMACNA and contract document details. Install turning vanes in the first 1/3 of all inside square elbows and extend vane runner past last blade and secure to duct

2.4 DUCT HARDWARE:

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
  1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, cover, for instrument tests. Ventlok No. 699 closures shall be provided and installed for each test hole, with sufficient neck length to penetrate the insulation.
  2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork. (Bare duct - Ventlok 620, 635; Insulated duct - Ventlok 627, 628, 637, 638, 629.)



- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
  - 1. Ventfabrics, Inc.
  - 2. Young Regulator Co.

**2.7 FLEXIBLE CONNECTIONS:**

- A. Extent of Work: Provide flexible connections between ductwork or plenums and equipment, such as at fan inlets and discharges, and at other places indicated on the drawings or called for by note or specification.
- B. Non-Corrosive Environment or Airstream: Provide material of heavy waterproof woven glass fabric double coated with neoprene or hypalon equivalent to "Ventglas" for interior locations and "Ventlon" for exterior locations, fabric not less than 3-1/4" wide clamped between strips of 24 gauge galvanized iron. Material by Ventfabrics, Inc., Chicago, Ill.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.2 INSTALLATION OF DUCTWORK ACCESSORIES:**

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install hand operated volume and splitter dampers at locations and of sizes shown. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct. Where ducts are insulated, the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be at least 1-1/2 times as long as the narrowest adjacent split, except where otherwise detailed. Splitter adjustment, accessible at fact of finishing ceiling, or equal units by Young Regulator. Splitter dampers and butterfly dampers may be constructed by the Sheet Metal Contractor. All multi-blade hand dampers shall be the product of one of the manufacturers listed in the Contract Documents. All operator fittings shall be heavy duty commercial grade. . Test all hand dampers for operability immediately after installation. Dampers shall actuate from fully closed to fully open position with no binding or interference. Dampers found non-operable during Test and Balance will be repaired at the contractor's expense.
- C. Install turning vanes in the first 1/3 of all inside square outside radiused elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- E. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 FIELD QUALITY CONTROL:

- A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.4 ADJUSTING AND CLEANING:

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
  - 1. Final positioning of manual dampers is specified in Division 23 section "Testing, Adjusting, and Balancing".
  - 2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 239100

SECTION 239400 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY:

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
  - 1. Ceiling air diffusers and grilles.
  - 2. Roof Caps
- C. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division 23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.
  - 1. The Installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
  - 2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
  - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
  - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
  - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

- B. Samples: 3 samples of each type of finish furnished.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

1.5 REFERENCES:

- A. Codes and Standards:
  - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
  - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
  - 3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
  - 4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
  - 5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 GRILLES AND DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

- D. Adjust all grilles and diffusers to fit neatly in the room ceiling pattern. Set final locations per architectural reflected ceiling plans.
- E. Volume Control Dampers: Provide duct mounted dampers of the externally adjustable opposed blade type where more than one grille or register is on a common duct. Provide access to each damper adjustment.
- F. Sound Level: The diffuser or grille generated noise shall not exceed the following sound power level curve at a point five feet away from the diffuser or grille.

Meeting Rooms: NC 25-30  
Court Rooms: NC 20-25  
Office Areas: NC 25-30

- G. Fire Dampers: Install fire dampers or smoke/fire dampers at the diffusers, registers and grilles as indicated on drawings or required by code.
- H. Manufacturers: Subject to compliance with requirements, provide grilles and diffusers of one of the following:

- |                  |                                |
|------------------|--------------------------------|
| 1. Hart & Cooley | 7. Tuttle & Bailey             |
| 2. Krueger       | 8. Anemostat/Waterloo          |
| 3. J and J       | 9. Agitair                     |
| 4. Carnes        | 10. Environmental Air Products |
| 5. Titus         | 11. Nailor                     |
| 6. EH Price      |                                |

- I. Types: Provide grilles and diffusers of type, capacity, and with accessories and finishes as listed on grille and diffuser schedule and as specified herein.

- J. Grilles and Diffusers:

1. Ceiling Supply Diffuser (S-1): Krueger Series 1400A with adjustable tabs for directional air flow control, square face, round neck, four-way deflection, anti-smudge design, removable inner core, all steel construction, appropriate mounting frame, white baked enamel finish, sponge rubber gasket, size as indicated on drawings.
2. Ceiling Supply Diffuser (S-2): Krueger series DMGDR, heavy duty steel construction, double deflection blades, optional damper/extractor, duct mounted with sponge rubber gasket, anti-smudge design, white baked enamel finish, size as indicated on drawings.
3. Perforated Return Grille (R-1): Krueger series 6490. Concealed hinge frame, sponge rubber gasket, white baked-on enamel, color as selected by architect, size as indicated on drawing.
3. Sidewall Return Register (TG-1): Krueger series S80H. Heavy duty steel construction, Horizontal blades at 0° deflection with 1/2" spacing, mounting frame with concealed fasteners, sponge rubber gasket, white baked enamel finish, size as indicated on drawings.

## 2.1 ROOF CAPS:

- A. Spun aluminum gravity roof ventilators shall be manufactured of heavy gauge aluminum utilizing spinning techniques to prevent warping inherent with drawing processes. The hood of the unit shall be easily removable for access to components beneath the ventilator. The base shall incorporate an integral spun inlet and shall be fully welded at

the corners to ensure a weather-tight installation. Provide with birdscreen, roof curb, and gravity backdraft damper.

- B. Manufacturers: Subject to compliance with requirements, provide exhaust roof caps of one of the following:
  - 1. Cook (Type PR)
  - 2. Greenheck
  - 3. Penn

### PART 3 – EXECUTION

#### 3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION:

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

END OF SECTION 239400

SECTION 239550 - MECHANICAL CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 General Mechanical Requirements sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.
  - 1. See following sections for types of Control Systems included as a part of this section. See electrical, etc.
  - 2. Control sequences are specified in this section under: "Sequence of Operation".
- B. Refer to other Division 23 sections for installation of dampers in mechanical systems.
- C. Refer to Division 26 sections for the following work.
  - 1. Power supply wiring from power source to power connection on controls and/or unit control panels. Includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
  - 2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.
    - a. Interlock wiring specified as factory-installed is work of this section.
- D. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
  - 1. Control wiring between field-installed equipment, controls, indicating devices, and unit control panels. All control wiring shall be in conduit.
  - 2. 120 volt service required by control systems.
- E. Participate in "System Commissioning, Testing and Balancing".

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: The HVAC controls shall be electric/electronic type
- B. Installer's Qualifications: Firms and workmen specializing and experienced in electric control system installations for not less than 5 years.
- C. Codes and Standards:
  - 1. Electrical Standards: Provide electrical products which have been tested, listed

- and labeled by UL and comply with NEMA standards.
2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
  3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
  4. Comply with NEPA 70, "National Electric Code" for all electrical installation.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.
- B. Shop Drawings: Submit shop drawings for each control system, containing the following information:
  1. Schematic flow diagram of system showing furnace, condensing unit, roof top unit, dampers, and control devices.
  2. Label each control device with setting or adjustable range of control.
  3. Indicate all required electrical wiring. Clearly differentiate between portions of work that are factory-installed and portions to be field-installed. Note contract responsibility to provide complete system regardless of delegation. Completely interface with and show existing installation in the Administration building.
  4. Provide details of faces of control panels, including controls, instruments, and labeling.
  5. Include verbal written description of sequence of operation. Confirm correct function of proposed sequences.
- C. Samples: Submit sample of each type of proposed thermostat cover to ensure they match existing.
- D. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Section 231950.

1.5 DELIVERY, STORAGE, AND HANDLING: Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

1.6 INSTRUCTION OF OWNER'S PERSONNEL: (See Section 230000)

- A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.
- B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.
- C. Prepare an outline of information to be conveyed, list materials available for reference. Submit to Architect along with a proposed schedule of instruction. Schedule to allow individual time for each trade and each system.



- D. Convey information in formal classroom session. Teachers to include qualified contractor personnel and sales representatives for each major piece of equipment. Go from the classroom to the actual location to graphically illustrate concepts discussed.
- E. Each and every session shall be video taped by the Contractor and given to the Owner.

**1.7 WARRANTIES:**

- A. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion).
- B. Warrant the overall assembly of equipment, materials and labor comprising these systems.

**1.8 CLEANING AND LUBRICATION:** All instruments, and control panels shall be thoroughly cleaned before final acceptance.

**1.9 TESTING AND ADJUSTING OF SYSTEM:**

- A. During the system commissioning, testing and balancing of the various building systems, have a controls representative(s) present and available to interpret and adjust controls as needed. Demonstrate and report the integrity and accuracy of each function and control point.
- B. At the termination of the testing period, the Controls representative shall spend a minimum of 4 hours instructing the Owner's operating personnel in the control system operation, and checking each system for day-night and manual override with the Owner's operating personnel on each furnace system. A complete operating booklet shall be provided and used during the training period. Schedule this training with the Owner and Mechanical Contractor.
  - 1. Since system performance is partly a function of climatic conditions, the Controls contractor shall be available during the changing seasons of the warranty period to make further adjustments and modifications if required. A final complete check of all systems shall be made at the conclusion of the one year warranty period.

**PART 2 - PRODUCTS**

**2.1 CONTROL CABINETS:** Furnish stamped steel with hinged door and locking latch control cabinets to protect and conceal all control devices. Arrange components neatly to provide adequate maintenance opportunity and proper device function. Label all components, numerically code all piping and wiring. Terminate all wiring at terminal blocks. Provide engraved plastic labels for all panel face devices.

- A. Provide with fuse - quantity as required.
- B. Provide with transformer 120/24 VAC quantity as required.

**2.2 CONTROL DAMPERS:**

- A. In supplying dampers, instruct the sheet metal workers in the proper installation of the dampers. Ductwork shall be reinforced and the damper properly supported without strain.
- B. Protect all dampers mounted in a duct system which requires special treatment.
- C. Provide damper operators with motors of proper size, so that the motors will operate against the static pressure of the systems. Provide each damper motor with a bracket for attaching to ductwork, building structure or equivalent. Damper motors in plenums shall be mounted on damper frames. Do not install motors in ducts. Modulating motors where indicated shall be provided with integral steps for both minimum and maximum stop.
- D. Control dampers for outside air, relief air, exhaust air, ventilating air and other dampers exposed to weather temperatures in built-up systems. Low leakage type with spring loaded side seals, inflatable butyl or neoprene fabric edge seals, bronze or teflon bearings, reinforced galvanized steel blades. Parallel action. Air leakage not to exceed 10 CFM per square foot at 4" upstream static pressure.
  - 1. Johnson "Proportion-Aire" D-1200/D-1300.
  - 2. Ruskin CDR-25
  - 3. Greenheck VCD-43

#### 2.4 TRANSFORMER

- A. 120/24 volt, 38VA Honeywell AT72D1188, cover mount
- B. 120/24 volt, 50VA Honeywell AT87A1106, foot mount

#### 2.5 DAMPER ACTUATORS

- A. Electric type equipped for Class I wiring.
- B. Shall not consume power during UNOCCUPIED cycle or use chemicals or expandable media.
- C. Have built in spring return.
- D. Approved Manufacturer & Model –
  - 1. Belimo LF-24

#### 2.6 CONDUCTORS

- A. Color coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
- B. Thermostat Cable - 12 conductor or 8 conductor, 18AWG solid copper wire, insulated with high density polyethylene. Conductors parallel enclosed in brown PVC jacket (No 22 AWG cable allowed).

#### 2.7 AUXILIARY RELAYS

- A. Light Duty - as required.
- B. Heavy Duty - Square D, Class 8501, Type X.

**PART 3 - CONTROL SEQUENCES**

**3.1 GENERAL:**

- A. Provide control systems to manage and manipulate mechanical equipment in a functional and energy conserving way.
- B. Locate control panels in the mechanical rooms with terminal block connections for interface of rooftop systems, etc.

**3.2 ROOFTOP HEAT PUMP (RHP-1 & 2):**

- A. **ROOFTOP HEAT PUMP CONTROL:** The DDC system energizes the fan section of the unit whenever the building is occupied based on a schedule dictated by the owner. Upon a drop in the average space temperature to below setpoint the DDC system energizes the rooftop heat pump reversing valve and compressor and provides heat to the spaces. As the zone temperature reaches setpoint the DDC system disengages the reversing valve while the fan section continues to run. Upon a rise in the average space temperature to above setpoint the DDC energizes the rooftop heat pump condensing section and provides cooling to the spaces. As the zone temperature reaches setpoint the DDC system disengages the condensing section while the fan section continues to run.

**3.3 AIR HANDLING UNIT (AHU-1):**

- A. Adapt existing control devices and replicate existing control sequence for the new air handling unit.

**END OF SECTION 239550**

SECTION 239650 - ELECTRICAL CONTROL SYSTEMS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS: See Division 23 "Mechanical Control Systems".
- 1.2 SUMMARY:
  - A. Electric control functions and systems indicated on the drawings and specified herein.
  - B. Complete interrelationships with pneumatic-control systems, automation systems and mechanical equipment.
- 1.3 QUALITY ASSURANCE: See Division 23 "Mechanical Control Systems".
- 1.4 SUBMITTALS: Division 23 "Mechanical Control Systems".
- 1.5 DELIVERY, STORAGE AND HANDLING: Division 23 "Mechanical Control Systems".
- 1.6 INSTRUCTION OF OWNER'S PERSONNEL: Division 23 "Mechanical Control Systems".

PART 2 – MATERIALS AND METHODS

- 2.1 ELECTRICAL POWER SUPPLY:
  - A. Obtain power from existing Division 26 panel. Furnish appropriate circuit breakers and extend conduit and wiring assigned to this division.
  - B. Furnish and install UL listed voltage reducing transformers required for this work. Size transformers to see no more than 70% of rated capacity at full load.
  - C. Make all electrical installations in conformance with the National Electrical Code (current edition) and in accordance with Division 26.
  - D. Use same product lines for similar devices as used by Division 260000 to result in a coherent project.
  - E. Control Wiring
    - 1. Provide plenum rated control cabling to match existing which is compatible with the existing control system.
    - 2. Number and code all wiring.
  - F. Use no wire smaller than 18 gauge.

PART 3 - INSTALLATION

- 3.1 CLEANING AND LUBRICATION: Division 23 "Mechanical Control Systems".
- 3.2 TESTING AND ADJUSTING OF SYSTEM: Division 23 "Mechanical Control Systems".

END OF SECTION 239550

SECTION 239700 – DDC CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The DDC Controls Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified for all new equipment, adapt existing controls to new equipment where indicated. The system shall include all required computer programming, software and license upgrades, hardware, controllers, sensors, transmission equipment, connection to existing workstations, local panels, conduit, wire, installation, engineering, database and setup, supervision, commissioning, acceptance test, training, warranty service and, at the owner's option, extended warranty service.
- B. The system shall only employ BACnet or Lontalk communications in an open architecture with the capabilities to support a multi-vendor environment. The system shall be capable of integrating third party systems and utilizing the following standard protocols.
  - 1. BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001.
  - 2. OPC server communications according to OPC Data Access 2.0 and Alarms and Events 1.0.
  - 3. LonWorks communication using LonTalk protocol.
  - 4. Modbus communication for integration to third party devices.
- C. The DDC System shall be web based and shall provide total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.
- D. The DDC System shall demonstrate, with (3) proof sources, integration with HVAC industry open standard protocols, including LonMark, BACnet, ModBus, OPC and Internet standard SQL database and HTTP / HTML / XML text formats.
- E. The DDC System shall communicate to third party systems such as VFD's, boilers, air handling systems, other energy management systems, access control systems, fire-life safety systems and other building management related devices using any of the open, interoperable communication protocols referenced in Paragraph D.
- F. All materials and equipment used shall be standard components, regularly manufactured with standard part numbers and owner's manuals for this and/or other systems. One of a kind, third party or custom integrations devices designed especially for this project will not be allowed.

1.2 RELATED SECTIONS:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Products furnished but not installed under this section:

1. Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under section 230000.
2. Automatic dampers to be installed under section 230000.

C. Coordination with electrical:

1. Installation of all line voltage power wiring by Division 26.
2. Each motor starter provided under Division 26, shall be furnished with individual control power transformer to supply 120 volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

1.3 QUALITY ASSURANCE

- A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- B. At the time of bid, all DDC System Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:
1. Underwriters Laboratory, UL 916
  2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

- A. Submit 4 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
  2. Equipment data cut sheets
  3. System schematics, including:
    - a. sequence of operations
    - b. point names
    - c. point addresses
    - d. point to point wiring
    - e. interface wiring diagrams
    - f. panel layouts
    - g. system riser diagrams
  4. AutoCAD® compatible as-built drawings.
  5. ATC Submittals shall be completed using HVAC Solution Software. AutoCAD files will be accepted on components and systems which HVAC Solution does not support. The main Bulk of the submittals shall be submitted using HVAC Solution.
- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
1. Index sheet, listing contents in alphabetical order
  2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
  3. Description of sequence of operations
  4. As-Built interconnection wiring diagrams
  5. User's documentation containing product, system architectural and programming information.

6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
8. Conduit routing diagrams
9. Copy of the warranty/guarantee
10. Operating and maintenance cautions and instructions
11. Recommended spare parts list

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Delta Control (must integrate with existing Siemens Controls)
- B. Invensys by Yamas Controls (must integrate with existing Siemens Controls)
- C. Johnson Controls (must integrate with existing Siemens Controls)
- D. Siemens Building Technologies
- E. Staefa Control System (must integrate with existing Siemens Controls)
- F. Andover by Utah Controls (must integrate with existing Siemens Controls)

2.2 The DDC Control System shall be comprised of a network of interoperable, stand-alone digital controllers. The DDC System shall incorporate LonWorks technology using Free Topology Transceivers (FTT-10), or BACnet MSTP485 or Ethernet in all unitary, terminal and other device controllers. The system shall include:

- A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions.
- B. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions.
- C. Application Specific Controllers (ASC's) for control of VAV terminal units, Fan coil terminal units, Unit Vent terminal units, Heat Pump units and other terminal equipment.
- D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.

2.3 The controller network shall use twisted pair wiring or loop. The PEC and ASC network shall communicate at a minimum 78Kbps using BACnet or Lontalk. The GUI and NAC shall reside on an Ethernet backbone.

2.4 All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices.

### 2.5 NETWORK AREA CONTROLLER (NAC)

- A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
  1. Calendar functions

2. Scheduling
  3. Trending
  4. Alarm monitoring and routing
  5. Time synchronization
  6. Integration of LonWorks controller data
  7. Integration of BACnet and MODBUS networks
- C. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall be capable of supporting multiple users, expandable to fifty.
- E. The NAC shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
  2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
    - a. To alarm
    - b. Return to normal
    - c. To fault
  3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
  4. Provide timed (schedule) routing of alarms by class, object, group, or node.
  5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Alarms shall be annunciated in any of the following manners as user defined:
1. Screen message text
  2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
    - a. Day of week
    - b. Time of day
    - c. Recipient
  3. Pagers via paging services that initiate a page on receipt of email message
  4. Graphic with flashing alarm object(s)
  5. Printed message, routed directly to a dedicated alarm printer
  6. Cell phones
- G. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
  2. Location (building, floor, zone, office number, etc.)
  3. Equipment (air handler #, access way, etc.)
  4. Acknowledge time, date, and user who issued acknowledgement.
- H. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- I. A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user.



- J. Provide a “query” feature to allow review of specific alarms by user defined parameters.
- K. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- L. An Error Log to record system errors shall be provided and available for review by the user.
- M. Data Collection and Storage
  - 1. The NAC shall collect data for any property of any object and store this data for future use.
  - 2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
    - a. Designating the log as interval or deviation.
    - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
    - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
    - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
    - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
  - 3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a standard Web Browser.
  - 4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
  - 5. All log data shall be available to the user in the following data formats:
    - a. HTML
    - b. XML
    - c. Plain Text
    - d. Comma or tab separated values
  - 6. The NAC shall have the ability to archive it’s log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
    - a. Archive on time of day
    - b. Archive on user-defined number of data stores in the buffer (size)
    - c. Archive when buffer has reached its user-defined capacity
- N. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it’s user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
  - 1. Time and date
  - 2. User ID
  - 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- O. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time of day.
  - 1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

## 2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

- A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.
- B. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001 or Lonworks FT110.
- C. The PEC must communicate peer-to-peer with all of the network application specific, programmable controllers and third party LonMark devices.
- D. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
- E. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
- F. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- G. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
- H. Each PEC shall support firmware upgrades without the need to replace hardware.
- I. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.
- J. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
  1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
  2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime and re-load time.
- K. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.

**2.7 APPLICATION SPECIFIC CONTROLLERS (ASC)**

- A. Each Application Specific Controller (ASC) shall operate as a stand-alone Lon Mark or BacNet controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.
- B. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power.
- C. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.
- D. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.
- E. After a power failure the ASC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

**2.8 GRAPHICAL USER INTERFACE SOFTWARE (GUI)**

- A. Provide programming time to display new units on existing graphics.

**2.9 WEB BROWSER CLIENTS**

- A. Provide programming time to display new units on existing graphics.

**2.10 PROJECT SPECIFIC WEB PAGES:**

- A. Provide programming time to display new units on existing graphics. New graphics shall match existing, except provide any additional points indicated on the drawings.

**2.11 FIELD DEVICES**

- A. Provide automatic control valves, automatic control dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.

**B. TEMPERATURE SENSORS**

- 1. Temperature Sensors: Temperature sensors shall be linear precision elements with ranges appropriate for each specific application.
- 2. Space (room) sensors shall be supplied with set point adjustment and override switch.
- 3. Duct mounted averaging sensors shall utilize a sensing element incorporated in a copper capillary with a minimum length of 20 feet. The sensor shall be installed according to manufacture recommendation and looped and fastened at a minimum of every 36 inches.

4. Sunshields shall be provided for outside air sensors.
  5. Thermo-wells for all immersion sensors shall be stainless steel or brass as required for the application.
- C. Pressure Transmitters: Differential or Gauge (static) Pressure Transmitters shall be solid state capacitance type. Transmitters shall have an output of 4 to 20 MA DC or 0-5 volts in accordance with ISA Standard 550.1 and shall operate from a power supply of 15 to 35 volts DC. Total affects of hysteresis, linearity and repeatability shall be plus or minus 1.0 percent of full scale or less, and repeatability shall be less than 0.3 percent of full scale. Variations in output signal per input supply voltage shall not exceed 0.02 MA output per 1.0 volt input change. The transmitters shall be totally enclosed, and shall have factory set zero and span adjustments that are accessible without removing the cover. Transmitters shall not be damaged by pressures at five (5) times the full scale pressure and shall be selected for the appropriate pressure range. Provide transmitters with LCD readout.
- D. SWITCHES AND THERMOSTATS
1. The DDC System Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.
  2. Duct Smoke Detectors: Duct smoke detectors shall be supplied by others with an integral auxiliary contact to be used by the DDC System Contractor to provide a digital input to the DDC System .
  3. Low Temperature Detection Thermostats: Shall be the manual reset type. The thermostat shall operate in response to the coldest one-foot length of the 20-foot sensing element, regardless of the temperatures at other parts of the element. The element shall be properly supported to cover the entire downstream side of the coil with a minimum of three loops. Separate thermostats shall be provided for each 25 square feet of coil face area or fraction thereof.
  4. Pressure Switches: Pressure Switches shall have a repetitive accuracy of plus or minus 2 percent of the operating range. Pressure Switches shall be the diaphragm type with adjustable actuation over the operating range. The switches shall have snap action form C SPDT or DPDT contacts rated for the application.
  5. Current Sensing Relays: Hawkeye Series 700, status switch capable of sensing a broken belt.
  6. Flow Switches: Motor status indications, where shown on the plans, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.

## 2.12. INSTALLATION

1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
2. The electrical contractor shall complete power wiring. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

## 2.13. START-UP

1. 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.

#### 2.14. PRODUCT SUPPORT

1. Factory trained application engineering and service personnel that are thoroughly familiar with the SED2 drive products offered will be locally available at both the specifying and installation locations.

#### 2.15. WARRANTY

1. Warranty shall be 24 months from the date of shipment (with certified start-up).

### PART 3 – EXECUTION

#### 3.1 PROJECT MANAGEMENT

- A. Provide a project manager who shall, as a part of his duties, be responsible for the following activities:
  1. Coordination between the Controls Contractor and all other trades, Owner, local authorities and the design team.
  2. Scheduling of manpower, material delivery, equipment installation and checkout.
  3. Maintenance of construction records such as project scheduling and manpower planning and AutoCAD or Visio for project co-ordination and as-built drawings.
  4. Coordination/Single point of contact

#### 3.2 INSTALLATION METHODS

- A. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications.
- B. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.
- C. To run BACnet on the ethernet network, the installer is required to run, at minimum, plenum rated CAT 5e cabling for all runs associated with this network.
- D. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 16 specification.
- E. All Controllers, Relays, Transducers, etc., required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

#### 3.3 SYSTEM ACCEPTANCE

- A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.
- B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end to end test. Such that:
  - 1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
  - 2. All analog input channels shall be verified for proper operation.
  - 3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
  - 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
  - 5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
  - 6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.
- C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete as-built drawing sets, together with AutoCAD or Visio diskettes to the owner.
- D. Operation and Maintenance Manuals: Submit four copies of operation and maintenance manuals. Include the following
  - 1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.
  - 2. An operator's manual that will include detailed instructions for all operations of the system.
  - 3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
  - 4. A copy of the warranty/guarantee.
  - 5. Operating and maintenance cautions and instructions.

### 3.4 TRAINING

- A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.
- B. Factory trained control engineers and technicians shall provide training sessions for the Owner's personnel.
- C. The control contractor shall conduct six (6) four-hour training courses for the designated owners personnel in the maintenance and operation of the control system. One class

shall be given before system acceptance and the others monthly into the warranty/guarantee time period.

- D. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
  - 1. HVAC system overview
  - 2. Operation of Control System
  - 3. Function of each Component
  - 4. System Operating Procedures
  - 5. Programming Procedures
  - 6. Maintenance Procedures

### 3.5 WARRANTY/GUARANTEE

- A. The control system shall be warranted / guaranteed to be free from defects in both material and workmanship for a period of one (1) year of normal use and service. This warranty/guarantee shall become effective the date the owner accepts or receives beneficial use of the system.

END OF SECTION 239750

**SECTION 239950 - SYSTEM COMMISSIONING, TESTING AND BALANCING**

**PART 1 – GENERAL**

**1.1 GENERAL CONDITIONS:**

- A. Work of this section shall be subject to the requirements of the General Conditions of this contract, the General Mechanical Requirements, General Electrical Requirements and other sections where this work shares a responsibility.
- B. System commissioning and startup of the mechanical systems shall be the responsibility of the Mechanical Contractor and his subcontractors with the participation of the Electrical Contractor related to electrical work and the General Contractor related to general construction items.
- C. Testing and Balancing shall be the responsibility of the Mechanical Contractor under the direction of the General Contractor with the full participation of all of the mechanical and electrical trades employed on the project and shall include the participation of an independent testing and balance contractor to coordinate all elements of the work and to perform special technical services outlined herein.

**1.2 SYSTEM COMMISSIONING - EXTENT OF WORK:**

- A. The work required by this section includes but is not necessarily limited to the following:
  - 1. The pre-startup inspection of all systems and subsequent correction of any incorrect items.
  - 2. The initial first run inspections.
  - 3. System operations inspection.
- B. The intent of this work is to provide for proper installation, startup, service and operation of the mechanical systems in preparation for system balancing.
- C. Repair, replacement or adjustment of each item shall be performed by the installing contractor.
- D. Involves all new construction and those elements of existing construction which are affected by this project.

**1.3 TESTING AND BALANCING - EXTENT OF WORK:**

- A. This work incorporates a confirming checkout of construction work, individual component activation, and overall system activation into one work program which shall serve as the transition period from the Contractor's job to Owner's facility.
- B. The TAB Contractor shall be skilled in the operation and manipulation of systems and in the direction of parties involved in the work.
- C. Conduct and participate in the startup and shakedown of all mechanical systems installed and modified in this contract; test adjust and balance these systems to obtain optimum performance at a level which minimizes the required energy input, prepare and submit a complete report of work done and the final system condition obtained, participate in the



instruction of Owner's personnel in the proper operation of systems and equipment.

- D. Involves all new construction and those elements of existing construction which are affected by this project.

#### 1.4 QUALIFICATIONS OF SYSTEM COMMISSIONING AND TAB TEAM:

- A. Representatives of the General Contractor, Mechanical Contractor, etc., and Electrical Contractor shall be available on a daily basis through the commissioning and adjustment period. These men shall be experienced journeymen with prior experience in system operation and with specific experience on the construction of this project.
- B. Balancing shall be done by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with any engineering, contracting, or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. Approved firms to do this work are R & S Balancing, Salt Lake City, Utah or Barnett, Inc., Payson, Utah, or BTC Services, Salt Lake City, Utah or Certified Testing and Balancing, Inc., Riverton, Utah.
- C. The balancing work including air and hydronic portions shall be performed by the same firm having total responsibility for the final testing, adjusting and balancing of the entire system. A principal of the firm shall be directly involved in the project.
- D. The independent testing and balancing firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, take all readings and make all necessary adjustments.
- E. After all tests and adjustments are made a detailed written report shall be prepared and submitted for review, and shall bear the signature of the professional supervising the work. Final acceptance of this project will not be made until a complete and satisfactory report is received. Furnish four copies of the report.

## PART 2 - EXECUTION, SYSTEM COMMISSIONING

### 2.1 PRE-STARTUP INSPECTION:

- A. The pre-startup inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.
- B. All pertinent items shall be checked, including but not necessarily limited to the following:
  - 1. Removal of shipping stops.
  - 2. Vibration isolators properly aligned and adjusted.
  - 3. Flexible connections properly aligned.
  - 4. Belts properly adjusted.
  - 5. Belt guards and safety shields in place.
  - 6. Safety controls, safety valves and high or low limits in operation.
  - 7. All systems properly filled.
  - 8. Filters in place and seal provided around edges.
  - 9. Fire dampers and smoke dampers properly installed and linked. Access doors provided for every damper.
  - 10. Pressure and temperature gauges installed.

11. All test stations and measuring devices installed.
12. Initial lubrication of equipment is complete.
13. Filters and strainers are clean.
14. Motor rotations are correct.
15. Voltages match nameplate.
16. Control system is in operation.
17. All interlocks are wired and verified.
18. All controls have been connected and verified.
19. All valves, dampers and operators are properly installed and operating.
20. All ductwork is installed and connected.
21. All other items necessary to provide for proper startup.

## 2.2 FIRST RUN INSPECTION:

- A. Recheck all items outlined in pre-startup inspection to insure proper operation.
- B. Check the following items:
  1. Excessive vibration or noise.
  2. Loose components.
  3. Initial control settings.
  4. Motor amperages.
  5. Heat buildup in motors, bearings, etc.
  6. Control system is properly calibrated and functioning as required.
- C. Correct all items which are not operating properly.

## 2.3 SYSTEM OPERATION INSPECTION:

- A. Observe mechanical systems under operating conditions for sufficient time to insure proper operation under varying conditions, such as day-night and heating-cooling.
- B. Periodically check the following items:
  1. Strainers and filters.
  2. Visual checks of air flow for "best guess" settings for preparation for system air balancing under section applying.
  3. Control operation, on-off sequences, system cycling, etc.
  4. Visual checks of water flow, seals, packings, safety valves, operation pressures and temperature.
  5. Dampers close tightly.
  6. Valves close tightly.
  7. System leaks.
  8. All other items pertaining to the proper operation of the mechanical system whether specifically listed or not.
  9. Proper combustion of fuels.
  10. Cleaning of excessive oil or grease.

## PART 3 - EXECUTION - TESTING AND BALANCING

### 3.1 TOTAL MECHANICAL SYSTEM BALANCE:

- A. The mechanical systems balance involves elements of the work of the General

Contractor, the Electrical Contractor, the Mechanical Contractor, the Sheet Metal Contractor and the Controls Contractor. Total system balance requires that all elements be not only individually correct, but also correct as a composite system. Therefore, participation of all parties shall be required in the test and balance procedure.

- B. Prior to beginning work, a written description of the anticipated sequence of action shall be submitted to the Architect/Owner for review and comment.
- C. The testing and balance specialist shall review the contract drawings during the bid period and shall advise the Architect of any modifications to the layout which may be needed to facilitate the balance procedure. Modifications will be incorporated into the contract by Addendum during the bidding period.
- D. The test and balance specialist shall visit the project from time to time during the rough installation making a thorough inspection of those items which will affect his subsequent work. He shall advise the Contractor in writing with a copy to the Architect of any work required by the contract which is not being performed adequately. This is in addition to the regular inspection efforts of the Architect and Engineer. Particularly note needed valves, dampers, access doors, thermometers, pressure gauges, belts and drives, diffuser styles, strainers and filters, etc.

### 3.2 AIR SYSTEMS BALANCE:

- A. Before any adjustments are made, check the systems for such items as dirty filters, duct leakage, filter leakage, damper leakage, equipment vibrations, correct damper operations, etc. Adjust all fan systems, major duct sections, registers, diffusers, etc., to deliver design air quantities within +5%. Individual air outlets, when one of three or more serve a space may have a tolerance of 10 percent from the average. Design static pressure is based on filters approximately 50% loaded with dirt. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed check motor amperage with the filters clean.
- B. Adjust supply, and recirculation air systems towards air quantities shown on drawings. Establish a proper relationship between supply and exhaust. Follow proportional balance procedures outlined by AABC and/or SMACNA for such work.
- C. Distribution system shall be further adjusted to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.

### 3.3 HYDRONIC SYSTEMS:

- A. Before any adjustments are made, clean strainers, check temperature control valve operation, check pump rotation, adjust pressure reducing valves, etc.
- B. Using system flow meters, pressure gauges, and/or contact pyrometer, adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements. Use proportional balance techniques to minimize system pressure requirements.
  - 1. Remove and trim pump impellers where throttling exceeds 10% of adequate flow.

- 3.4 MAJOR EQUIPMENT: The Testing and Balancing Contractor shall work with the Controls Contractor and Electrician in placing chiller, boilers, pumps, fans and other major equipment in operation. The factory representative of the equipment manufacturer shall also participate in a team effort to place the system(s) in operation, adapt to all anticipated operating modes and

make adjustments as required to obtain correct operation. The Design Engineer and the Owner's Representative shall witness the final operating sequences.

- A. Use proportional balance techniques so that in every case, at least one terminal valve is set for full flow at wide open, and at least one branch valve is wide open at full flow, others equivalent.

3.5 CONTROL SYSTEMS: The Testing and Balancing Contractor shall go through the entire control system with the Controls Contractor verifying proper operation of each and every device and the proper function of each system. Certify such effort in the report.

3.6 MISCELLANEOUS:

- A. Observe and note all furnished thermal overload protection in the data sheets. If thermal overload protection is incorrect, the trade which furnished the overload devices shall furnish and install the correct size overload protection devices. It shall be the responsibility of the balancing firm to confirm that proper overload protection has been installed at the completion of the job.
- B. Measure and set any special conditions such as minimum air quantities; coordinate outside air, return air and relief air damper operation; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in "REPORT" below.
- C. All balancing devices, i.e. dampers and valves, shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
- D. Upon request, based on perceived need, make 24-hour space temperature recordings. Any required rebalance of the system shall be performed without additional cost.
- E. Upon request, a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by reading back outlets or terminals selected specifically or at random by the Design Engineer. It is understood that the operating mode of the system shall be the same for read-back as it was during balancing.

3.7 REPORT:

- A. Provide a bound report in four copies containing a general information sheet listing instruments used, method of balancing, altitude correction, and manufacturer's grille, register and diffuser data.
- B. Provide equipment data sheets listing make, size, serial number, rating, etc. of all mechanical equipment including fans, air controllers, pumps, motors, starters and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils, and other system components, pump heads, and measured motor current and voltage.
- C. Balancing data sheets shall indicate the required and actual CFM of all supply, return and exhaust outlets or inlets, and be totaled and summarized by systems.
- D. Hydronic balancing data sheets shall list required temperature or pressure differentials used for balancing coils, radiations, condensers, etc. Sheets shall show in comparison final as-balanced versus design values.
- E. Include a reduced set of contract drawings with outlets marked for easy identification of

the signation used in the data sheets.

- F. Note any abnormal or notable conditions not covered in the above.
- G. Keep a daily log of all work performed, with a list of work scheduled for each day and the workers on the job.

END OF SECTION 239950

**SECTION 230000 - GENERAL MECHANICAL REQUIREMENTS**

**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 work of this section.
  - 1. Sections of other Divisions which relate to mechanical work apply to the work of this section. See various Sections on sitework, underfloor work, structural work, finish materials, etc.
- B. Related Sections: Refer to "Electrical Requirements for Mechanical Equipment" Section in Division 23 for basic electrical requirements for all mechanical equipment. Special and specific electrical requirements are specified within each respective equipment specification section.

**1.2 SUMMARY:** This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements of Division 01.

- A. This Division does not define, nor is it limited by, trade jurisdictions. All work described herein is a part of the General Contract and is required of the Contractor regardless.

**1.3 DESCRIPTION OF PROJECT:** The mechanical work described in these mechanical specifications is for a project located in Ogden, Utah. Design weather conditions are: 95° db, 62° wb, and winter 3°F. Altitude readings, unless otherwise noted, are for an elevation of 4,300 feet above sea level. Make adjustment to manufacturer's performance data as needed.

**1.4 CODES AND PERMITS, AUTHORITIES HAVING JURISDICTION:**

- A. Perform the mechanical work in strict accordance with the applicable provisions of the various codes ordinances and adoptions pertaining to the project location in effect on the date of invitation for bids. Provide all materials and labor necessary to comply with rules, regulations and ordinances. Where the drawings and/or specifications indicate materials or construction in excess of code requirements, the drawings and/or specifications govern.
- B. Hold and save the Owner and Architect/Engineer free and harmless from liability of any nature or kind arising from failure to comply with codes and ordinances.
- C. Secure and pay for permits necessary for the prosecution of the work under this contract. Contractor to pay all fees and include connection fees related to utility hookups. Include all sewer connection fees verifying current rate with Santa Clara City prior to bid.
- D. Reference Standards:

American Welding Society  
International Mechanical Code/State Code  
International Building Code/State Code

SMACNA Duct Design Standards  
Local/State Plumbing Code  
Locally enforced NFPA Codes  
Local Fuel Utility Regulations  
Local Power Utility Regulations  
American Gas Association  
ASME Codes for Pressure Vessels and Piping  
ANSI B31.1 Piping

- E. Final inspection by the Architect/Engineer will not be made nor Certificate of Substantial Completion issued until certificates of acceptability from the Authorities having jurisdiction are delivered.

1.5 DEFINITION OF PLANS AND SPECIFICATIONS: The mechanical drawings at reduced scale show the general arrangement of piping, ductwork, equipment, etc., and shall be followed as closely as the actual building construction and the work of other trades will permit. The architectural and structural drawings shall be considered as part of the work insofar as these drawings furnish the Contractor with information relating to design and construction of the building. Architectural drawings shall take precedence over mechanical drawings. Request clarification and participate in resolution in the event of conflict.

- A. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. Investigate the structural and finish conditions affecting the work and arrange the work accordingly, providing such extensions, fittings, valves and accessories to meet the conditions as may be required. Some small scale work is not shown such as control conduit and piping, incidental piping, specialties. Provide as directed by note or specification.
- B. Examine the actual construction site prior to bidding and obtain an understanding of the conditions under which the work will be performed. No allowances will be made for failure to make such examination.
- C. During construction, verify the dimensions governing the mechanical work at the building. No extra compensation shall be claimed or allowed because of differences between actual dimensions and those indicated on the drawings. Examine adjoining work on which mechanical work is dependent for perfect efficiency, and report any work of other trades which must be corrected. No waiver of responsibility for defective work shall be claimed nor allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 ROUGH-IN:

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications in Divisions 02 through 26 for rough-in requirements.

1.7 MECHANICAL INSTALLATIONS:

- A. Coordinate mechanical equipment and materials installation with other building components.
- B. Verify all dimensions by field measurements.

- C. Arrange for chases, slots, and openings in other building components to allow for mechanical installations.
- D. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- E. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- F. Coordinate the cutting and patching of building components to accommodate installation of mechanical equipment and materials.
- G. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- H. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of mechanical materials and equipment above ceilings with suspension systems, light fixtures, existing structures and other installations.
- J. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
- K. Where mechanical work penetrates other trade work such as gypboard walls, etc., penetration shall be neatly cut and walls shall be filled and patched.

1.8 ACCESSIBILITY:

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Extend all grease fittings to an accessible location.
- C. Establish required clearance to all installation features involving operation and maintenance. Respect manufacturers recommendations for access and clearance.
- D. Access Doors - General: All items of mechanical equipment which may require adjustment, maintenance, replacement or which control a system function shall be made readily accessible to personnel operating the building.
  - 1. Provide access doors in all ductwork or plenums as required to maintain fire dampers, fire smoke dampers, equipment, controls or other elements of the system. Doors shall conform to SMACNA standards unless otherwise detailed or specified.
  - 2. Provide access doors in floors, walls, ceiling and partitions to valves, cleanouts, chases, dampers, etc., and to access doors in ductwork requiring the same. Access doors shall be all-steel construction equivalent to "Milcor" by Inland



Ryerson in a style approved by the Owner's Representative. Doors shall be 24" x 24", or as needed, with screwdriver latches.

- 1.9 CHANGE ORDERS: See General Conditions.
- 1.10 ALTERNATIVE CONSTRUCTION/SUBSTITUTION: These documents outline a way in which the Owner may be delivered a functional and reliable facility. Drawings and specifications describe reasonable engineering practice for the Contractor to follow.
- A. Coordination between trades may result in periodic needs to adjust the installation from that indicated, but in no case shall the intended function be compromised.
  - B. The Contractor may perceive some work methods which differ from those specified which could save time and effort. These may be presented to the Architect with a breakdown of possible cost savings for review. Implement only with authorization.
  - C. Materials substitutions will generally be covered in a review process prior to bidding. After bidding, substitutions shall be proposed only on the basis of definitive cost accounting and implemented only with authorization.
- 1.11 CUTTING AND PATCHING:
- A. Lay out the project where new work is involved ahead of time, providing sleeves and blockouts, and have work specifically formed, poured and framed to accommodate mechanical installations. Cut and patch only as needed.
  - B. Refer to the Division 01 Section: CUTTING AND PATCHING for general requirements for cutting and patching.
  - C. Refer to Division 26 Section: BASIC ELECTRICAL REQUIREMENTS for requirements for cutting and patching electrical equipment, components, and materials.
  - D. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
  - E. Arrange for repairs required to restore other and any work damaged as a result of mechanical installations.
  - F. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
  - G. Perform cutting, fitting, and patching of mechanical equipment and materials required to:
    - 1. Uncover Work to provide for installation of ill-timed Work;
    - 2. Remove and replace defective Work;
    - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
    - 4. Remove samples of installed Work as specified for testing;
    - 5. Install equipment and materials in existing structures.
  - H. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
  - I. Cut, remove and legally dispose of selected mechanical equipment, components, and

materials as indicated, including, but not limited to removal of mechanical piping and other mechanical items made obsolete by the new Work.

- J. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

1.12 SUBMITTALS: Submittal of shop drawings, product data, and samples will be accepted only from the Contractor to the Architect. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed. Document each transmittal and sign and stamp the submittal indicating that it has been reviewed and is in compliance with the criteria of the project, any exceptions being clearly noted.

- A. Shop Drawings: As soon as possible after the contract is awarded, submit to the Architect, four (4) copies of the descriptive literature covering all equipment and materials to be used in the installation of mechanical systems for this project. Written confirmation of acceptable review by the Owner's Representative shall be obtained before ordering, purchasing, acquiring or installing any such equipment or materials for the project.

1. Prepare the submittals in an orderly manner after the order of this specification, contained in a three-ring loose-leaf binder(s) with an identification tab for each item or group of related items. Submitted literature shall clearly indicate performance, quality, utility requirements, dimensions, connection points and other information pertinent to effective review.
2. Equipment must fit into the available space with allowance for operation, maintenance, etc. The Contractor shall take full responsibility for space and utility requirements for equipment installed.
3. Factory-wired equipment shall include shop drawings of all internal wiring to be furnished with unit.
4. Review of the Architect/Engineer is for general conformance of the submitted equipment of the project specification; in no way does such approval relieve Contractor of his obligation to furnish equipment and materials that comply in detail to the specification, nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions which may affect his work.

- B. Record Drawings: During the course of construction, maintain a set of drawings, specifications, change orders, shop drawings, addenda, etc., for reference and upon which all deviations from the original layout are recorded. Turn these marked-up documents over to the Architect/Engineer at the conclusion of the work so that the original tracings can be revised. If the Contractor fails to mark up the prints, reimburse the Architect/Engineer for time required to do so.

1.13 OPERATION AND MAINTENANCE TRAINING:

- A. Instruction Of Owner's Personnel: At a time prior to Owner making use of a device or system, and in general after testing and balance work for a building or major system is complete, prepare, schedule and conduct a series of training sessions for Owner's operating and supervisory personnel. Instructions shall cover each device and system with emphasis on understanding of the purpose and function, the maintenance requirements and the proper adjustment and operating technique.
- B. Instruct building operating staff in operation and maintenance of mechanical systems utilizing Operation and Maintenance Manual when so doing.
- C. Contractor to video tape instruction sessions, and give video tape to owner.

- D. Minimum instruction periods shall be as follows:
    - 1. Mechanical - four hours, total.
    - 2. Temperature Control - four hours, total. Programming help as needed.
  - E. Initial instruction periods shall occur after pre-final inspection when systems are properly working and before final payment is made.
  - F. None of these instructional periods shall overlap another.
  - G. Vendors for each piece of equipment controls, etc., shall participate along with the Contractor(s).
- 1.14 **GUARANTEE/WARRANTY:** The following guarantee is a part of this specification and is binding on the part of the Contractor and his assigns:
- A. "Contractor guarantees that this installation is in accordance with the terms of the Contract and is free from mechanical defects. He agrees to replace or repair, to the satisfaction of the Owner's Representative, any part of this installation which may fail or be determined unacceptable within a period of one (1) year after final acceptance. See also the General Conditions of these specifications. Failed equipment in the repair or replacement shall be guaranteed for one full year from the date of recommission."
  - B. Compile and assemble the warranties required by Division 23 into a separated set of vinyl covered, insert sheets, tabulated and indexed for each reference, included in the O & M Manual.
  - C. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.
  - D. Mechanical systems and equipment shall not be considered for substantial completion and initiation of warranty until they have performed in service continuously without malfunction for at least thirty (30) working days.
- 1.15 **TESTS AND CERTIFICATIONS:** Make all tests required by code or specification in the presence of a representative of the Owner, with tests recorded and certified by the Contractor and Representative. Involve local authorities where required.
- 1.16 **PERMITS, FEES, LICENSES:** Refer to General Conditions. See Paragraph 1.04.
- 1.17 **CEILING SPACE COORDINATION:** Carefully coordinate ceiling cavity space with all trades; however, installation of mechanical equipment within the ceiling cavity space allocation, in the event of conflict, shall be in the following order: plumbing waste lines; supply, return and exhaust ductwork; domestic hot and cold water; fire protection; control conduit. Respect clearances required for lights, electrical conduits, protected structure, etc. All spaces above any and all ceilings shall be defined and considered as return air plenum space.
- 1.18 **MECHANICAL COORDINATION DRAWINGS:** For the entire building including all floor spaces, mechanical rooms, congested areas, or areas of great detail, prepare and submit a set of coordination drawings showing major elements, components and systems of mechanical equipment and materials in relationship with other building components (structure, fire sprinkler,

electrical, etc.). Prepare drawings to an accurate scale of 1/4" - 1-0" or larger. Indicate the locations of all equipment and materials, including clearances for installing and maintaining equipment, servicing and maintaining equipment, valve stem movement, and similar requirements. Indicate movement and positioning of large equipment into the building during construction. Prepare floor plans, reflected ceiling plans, elevations, sections and details to conclusively coordinate and integrate all installations. Indicate locations where space is limited, and where sequencing and coordination of installations are of importance to the efficient flow of the work, including (but not necessarily limited to) the following:

- A. Ceiling plenums which contain piping, ductwork, or equipment in congested arrangement. To include structure, ductwork, piping, fire protection, large electrical conduit, recessed lights, etc.
- B. Pipe expansion loops.
- C. Numbered valve location diagrams.
- D. Manifold piping for multiple equipment units.
- E. General floor plan layouts with ductwork, piping, lighting, structure, etc.
- F. Use drawings to coordinate all affected trades. Do not work without coordinated drawings.

## **PART 2 - GENERAL MECHANICAL MATERIALS AND METHODS**

### **2.1 QUALITY OF MATERIALS AND EQUIPMENT:**

- A. All equipment and materials shall be new, and shall be the standard products of manufacturers regularly engaged in the production of plumbing, heating, ventilating and air conditioning equipment, and shall be the manufacturer's latest design. Specific equipment shown in schedules on drawings and specified herein is to be the basis for the Contractor's bid. Provisions for substitute equipment are outlined in the General Conditions. All materials shall be produced by manufacturing plants located in the United States of America.
- B. Furnish and install all major items of equipment specified in the equipment schedules on the drawings complete with all accessories normally supplied with catalog items listed, and all other accessories necessary for a complete and satisfactory installation.

### **2.2 PROTECTION OF MATERIALS AND EQUIPMENT:**

- A. Close pipe and duct openings with caps or plugs to prevent lodging of dirt or trash during the course of installation. Cover equipment tightly and protect against dirt, water and chemical or mechanical injury. Plumbing fixtures intended for the final installation shall not be used by the construction forces. At the completion of the work, clean fixtures, equipment and materials and polish thoroughly and deliver in a factory dock condition for the Owner's acceptance. Make damage and defects developing before acceptance of the work good at Contractor's expense.
- B. Do not make temporary use of project equipment, new or existing, during construction without the consent of the owner. **DO NOT USE SYSTEM FOR TEMPORARY HEAT!!**

**2.3 QUALIFICATIONS OF WORKMEN:**

- A. All mechanics shall be capable journeymen, skilled in the work assigned to them. Apprentices may be used with appropriate direction.
- B. Employ no unskilled persons in the work which he is given to do; execute all work in a skillful and workmanlike manner. All persons employed upon this work shall be competent, faithful, orderly and satisfactory to the Owner. Should the Owner's Representative deem anyone employed on the work incompetent or unfit for his duties, and so certify, Contractor shall dismiss him and he shall not be again employed upon the work without permission of the Owner's Representative.
- C. All welders involved in welding of pressure piping systems shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Written verification of successful test completion shall be submitted to Architect prior to initiating work.

**2.4 FOREMAN:** Dedicate and designate a full-time general mechanical foreman to the Owner's Representative to be consistently available on site during the life of the project for consultation. Do not replace this individual without prior approval from the Owner's Representative.

**2.5 USE OF COMMON VENDORS:** Regardless of subcontract delegations, coordinate purchasing between trades so that equipment and materials of similar nature come from a single vendor, i.e., all package HVAC terminal units shall be common source. Valves, variable volume boxes, speed drives, etc., the same. Do not burden the Owner with multiple brands of similar equipment unless so directed.

**2.6 ROOF/WALL/FLOOR PENETRATIONS - FLASHINGS:**

- A. Install sleeves through the floor into "dry rooms" flush with the floor, caulked and sealed. Into wet rooms, extend piping to create 1" dam. Use Schedule 40 galvanized steel pipe for all pipe sleeves.
- B. Let pipe sleeves allow for movement of the pipe due to expansion and contraction, yet to include seismic restraint.
- C. Flashings:
  - 1. Flash all pipes penetrating the roof. Provide required flashing components.
  - 2. Clamp roof drains to roof membrane, follow manufacturer's directions.
  - 3. Flash and counter-flash other piping penetrating the roof. See drawings or Architect/Engineer for additional detail.
  - 4. Make all ductwork penetrating the roof watertight with flashings, counter-flashing and sealant. Provide curbs for all such openings.

**2.7 EXCAVATING AND BACKFILLING (GENERAL):**

- A. Provide all excavation, trenching and backfilling for Division 23000 underground duct and piping work. Excavation and backfilling shall comply with applicable paragraphs of Division 02. Tamp bottoms of trenches hard and, for soil and waste piping, grade to secure uniform fall of 1/4" per foot, or as noted. Excavate bell holes for hub and spigot pipes so that pipe rests on solid ground for its entire length. Lay sewer and water pipe in separate trenches, except where otherwise noted, as detailed.

- B. After work has been tested, inspected and approved by the Owner's Representative and/or State/Local Inspector, and prior to backfilling, clean the excavation of all rubbish, and clean backfill materials free of trash. Place backfill in horizontal layers not exceeding 12" in thickness, properly moistened. Mechanically compact each layer with suitable equipment to a dry density of not less than 95 percent as determined by the Modified AASHTO Test T-180. See Division 02 for additional requirements.
  - 1. Provide adequate shoring to safeguard workers from cave-ins for all excavations.
  - 2. In areas where General Contractor has finish grade work to do, Mechanical Contractor shall backfill and compact to 8" below finish grade. Where no finish surface work is to be done, Mechanical Contractor shall backfill and compact to and match adjacent undisturbed surface with allowance for settling, etc.
  - 3. Protect from damage all existing underground utilities or utility tunnels indicated on the contract drawings (or field located for the Contractor by the Owner prior to excavation operations). Any damage to identified existing utilities or utility tunnels shall be repaired by the Contractor at no cost to the Owner.

**2.8 HANGERS AND SUPPORTS (GENERAL):**

- A. Provide hangers and/or supports for all equipment, piping and ductwork. Primary information is contained in these specifications and on the drawings.
- B. Provide hangers and supports to correlate with seismic restraint and vibration isolation.

**2.9 MANUFACTURER'S DIRECTIONS:** Install all equipment in strict accordance with directions and recommendations furnished by the manufacturer. Where such directions are in conflict with the plans and specifications, report such conflicts to the Architect who shall direct adjustments as deemed necessary and desirable.

**2.10 LUBRICATION:** Lubricate equipment at startup. Then, provide all lubricants for the operation of all equipment until acceptance by the Owner. The Contractor is held responsible for all damage to equipment and bearings while the equipment is being operated by him consequent to pre-acceptance operation.

**2.11 ELECTRICAL WIRING AND CONTROL:**

- A. In general, motor starters, related motor starter equipment and power wiring indicated on the electrical drawings and control diagrams are to be furnished and installed under Division 260000 of this Specification. Items of electrical control equipment specifically mentioned to be furnished by the Division 23000 either in these specifications or on the electrical or mechanical drawings, shall be furnished and mounted by this Contractor and shall be connected under and as required by this Division 23000 and Division 260000 of these specifications.
- B. Refer to the control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the contractor.
- C. Division must be fully coordinated with Division 260000 to insure that all required components of the work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of coordination.
- D. Where the detailed electrical work is not shown on the electrical drawings, the

Mechanical Contractor shall furnish, install and wire or have prewired all specified and necessary controls for air handling equipment specified for this project. The objective of this paragraph is to make sure a complete operating system is obtained at no additional cost to the Owner for field wiring required related to the equipment.

2.12 FLUSHING AND DRAINING OF SYSTEMS/CLEANING OF PIPING AND DUCTS: Fill, clean and flush and sterilize where appropriate, all water piping systems with water and drain these systems before they are placed in operation. Blow out all other piping systems with compressed air or nitrogen to remove foreign materials that may have been left or deposited in the piping system during its erection. Duct systems shall have all debris removed and fans shall be run to blow out all dust and foreign matter before grilles, outlets or mixing boxes are installed and connected.

A. Damp wipe all ductwork on installation, cap open ducts, cover fan inlets, vacuum fan plenums and related installation before starting fans. Run fans only with filters in place.

2.13 JOBSITE CLEANUP:

A. Keep site clean during progress of work.

B. At the conclusion of work, clean all installation thoroughly.

1. Leave equipment in a factory dock condition. Correct any damage and touch up or repaint if necessary.
2. Remove all debris from site.

END OF SECTION 230000

SECTION 230005 - DEMOLITION

PART I - GENERAL

1.1 SECTION INCLUDES:

- A. Remove existing general, mechanical and plumbing installations in the remodel area which is no longer useful to the functions of the building.
- B. Maintain existing installations which continue in service or are adapted to new service.
- C. Adapt existing installation to new conditions, ie., remove and reinstall piping which must be offset or revised to accommodate new installation, layouts, etc.

1.2 REFERENCES:

- A. Respond to General Conditions, Supplemental General Conditions, Division 1, etc.

1.3 PROJECT/SITE CONDITIONS:

Work areas are in the existing general building areas, mechanical rooms and chase spaces. Ductwork and piping exists throughout the building. The building's utilities are to be restored to service. Be familiar with site conditions and be careful in the work.

1.4 SCHEDULING AND SEQUENCING:

Program and schedule any required interruptions of primary utility service with the General Contractor.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 MECHANICAL PIPING AND EQUIPMENT:

Remove all mechanical piping, related insulation, equipment and accessories in the remodeled areas rendered obsolete by this work. The contractor shall field coordinate existing work versus new and remove all piping, equipment, and accessories not required by new work to remain. Dispose of removed material offsite in an approved manner.

3.2 HVAC DUCTWORK AND EQUIPMENT:

Remove all HVAC ductwork, related insulation, equipment and accessories in the remodeled areas rendered obsolete by this work. The contractor shall field coordinate existing work versus new and remove all ductwork, equipment, and accessories not required by new work to remain. Dispose of removed material offsite in an approved manner.



3.2 CONTROLS:

Remove existing control system rendered obsolete by this work. Remove all control devices, and associated electrical wiring, control valves and dampers, cap or terminate wiring in existing junction boxes or at existing mains. Adapt existing control devices to new equipment providing all accessories required.

END OF SECTION 230005

SECTION 230600 - GENERAL PIPES AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. This section is Division 23 General Pipes and Fittings section, and is part of each Division 23 section making reference to pipes and pipe fittings specified herein.
- C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. This section is generic in that it describes material and installation required by several other sections of this specification.
- B. Types of pipes and pipe fittings specified in this section include the following:
  - 1. Steel Piping
  - 2. Galvanized Steel Piping
  - 3. Cross Linked Polyethylene
  - 4. Copper Piping
  - 5. Miscellaneous Piping Materials/Products.
- C. Pipes and pipe fittings furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 23 sections.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications:
  - 1. Firm with at least three years history of successful experience on projects of similar nature.
  - 2. Licensed as a firm in the contractor state of origin and in the State of Utah.
  - 3. Have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the contractor.
  - 4. All workmen employed on the project to carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, installation instructions, and dimensioned drawings for each type of pipe and pipe fitting. Submit piping schedule showing manufacturer, pipe or tube weight, fitting type, and joint type for each piping

system.

- B. Brazing Certifications: Submit reports as required for piping work.
- C. Maintenance Data: Submit maintenance data and parts lists for each type of mechanical fitting. Include this data, product data, and certifications in maintenance manual; in accordance with requirements of Division 01.

#### 1.5 REFERENCES:

- A. Codes And Standards:
  - 1. Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.
  - 2. Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.
  - 3. NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundation (NSF).

#### 1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Except for concrete, corrugated metal, hub-and-spigot, clay, and similar units of pipe, provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling, as required, to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping.
- C. Protect flanges and fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

### PART 2 - PRODUCTS

#### 2.1 GENERAL:

- A. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. Use United States (domestic) manufactured pipe only. Do not use foreign made pipe.
- B. Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable. Use domestic manufactured fittings only. Do not use foreign manufactured fittings.

**2.2 STEEL PIPES AND PIPE FITTINGS:**

- A. Black Steel Pipe: Seamless or ERW, ASTM A 53.
- B. Electric-Resistance-Welded Steel Pipe: ASTM A 135.
- C. Electric-Fusion-Welded Steel Pipe: ASTM A 671, A 672, or A 691.
- D. Galvanized Steel Pipe: ASTM A 53.
- E. Galvanized Seamless Steel Pipe: ASTM A 53.
- F. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
- G. Unions: ANSI B16.39; 300 lb. ground joint malleable iron, hexagonal, selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
- H. Dielectric Unions: 175 psig WSP at 250°F. Equal to Walter Vallet Company V-line insulating coupling.
- I. Threaded Pipe Plugs: ANSI B16.14.
- J. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
  - 1. Material Group: Group 1.1.
  - 2. End Connections: Buttwelding.
  - 3. Facings: Raised-face.
  - 4. Steel Pipe Flanges for Waterworks Service: AWWA C207.
- K. Forged-Steel and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe.
- L. Forged Branch-Connection Fittings: Except as otherwise indicated, provide type as determined by Installer to comply with installation requirements.
- M. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (no close-nipples).

**2.3 COPPER TUBE AND FITTINGS:**

- A. Copper Tube: ASTM B 88; Type K, L (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated. Do not use Type M for pressure piping.
- B. DWV Copper Tube: ASTM B 306.
- C. ACR Copper Tube: ASTM B 280.
- D. Cast-Copper Solder-Joint Fittings: ANSI B16.18.

- E. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
- F. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
- G. Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.
- H. Cast-Copper Flared Tube Fittings: ANSI B16.26.
- I. Bronze Pipe Flanges/Fittings: ANSI B16.24.
- J. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

#### 2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS:

- A. Soldering Materials: Except as otherwise indicated, provide soldering materials as determined by Installer to comply with installation requirements. Use **no lead** bearing solders in domestic water applications.
  - 1. Tin-Antimony Solder: ASTM B 32, Grade 95TA.
  - 2. Silver-Lead Solder: ASTM B 32, Grade 96TS.
- B. Brazing Materials: Except as otherwise indicated, provide brazing materials as determined by Installer to comply with installation requirements.
  - 1. Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
- C. Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast-iron flanges; raised-face for steel flanges, unless otherwise indicated.
- D. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.
  - 1. Manufacturer: Subject to compliance with requirements, provide piping connectors of the following
    - a. Fernco, Inc.
- E. Strainers:
  - 1. Y pattern, self-cleaning, line size. Armstrong, Bailey, Crane, Fisher, Metraflex, Mueller, Sarco, Strong, or Yarway.
    - a. Iron Body, Screwed Ends 2" and Smaller: 250 psig at 425°F, screen mesh to suit service.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently- leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and

couplings, but with adequate and accessible union, flanges, etc., for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Do not cold spring. Store filler weld materials in accordance with codes.

1. Comply with ANSI B31 Code for Pressure Piping.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Provide high point vents, low point drains with valves and extension to drain for all piping.
- C. All piping in mechanical rooms, fan rooms, etc., shall be exposed. Do not conceal or imbed piping in walls, floors or other structures.
- D. Make changes in direction or size with manufactured fittings. Anchor and support piping for free expansion and movement without damage to piping, equipment or to building.
- E. Arrange piping to maintain head room and keep passageways clear.
- F. Provide unions at connections to equipment and elsewhere as required to facilitate the maintenance.
- G. Run full pipe size through shutoff valves, gas cocks, balancing valves, etc. Change pipe size within three pipe size diameters of final connection to equipment, coils, etc.
- H. Erect all piping to insure proper draining. Domestic water, chilled water, and heating water shall slope down a minimum of 1" per 40 feet towards the drains. Pitch standpipes down to fire department connections a minimum of 1" per 40 feet. Slope soil, waste, vent, and roof drain lines in accordance with requirements of Uniform Plumbing Code.
- I. On horizontal straight runs of pipe, use eccentric reducers with straight side on top for water piping.
- J. Electrical Equipment Spaces: Do not run piping in or through transformer vaults and other electrical or electronic equipment spaces and enclosures or above electrical gear unless authorized and directed. Install drip pan under piping that must be run through electrical spaces.
- K. Anytime lines are broken or disconnected they shall be capped immediately after flushing. If rocks or other foreign materials are found in the system after it has been closed, the Contractor shall stand the expense of their removal.

### 3.2 PIPING SYSTEM JOINTS:

- A. General: Provide joints of type indicated in each piping system.
- B. Threaded: Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.
- C. Brazed: Braze copper tube-and-fitting joints where indicated, in accordance with ASME B31.
- D. Soldered: Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

### 3.3 CLEANING, FLUSHING, INSPECTING:

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
  - 1. Inspect pressure piping in accordance with procedures of ASME B31.
- B. Flush, treat and clean portions of the heating water system modified under this contract in accordance with Sections chemical treatment. Certify by signature of Contractor and Owner's Representative.

### 3.4 PIPING TESTS:

- A. General: Provide temporary equipment for testing, including pump and gages. Test the piping system before insulation is installed, and wherever feasible remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
  - 1. Required test period is 2 hours.
  - 2. Test long runs of Schedule 40 pipe at 150 psi, except where fittings are lower Class or pressure rating.
  - 3. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.
  - 4. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drop exceeds 5% of test pressure.
- B. Notifications: At least 10 days prior to commencement of required testing, notice shall be submitted for review. Tests shall be made prior to painting insulating or covering of any joints and shall be in accordance with ANSI Code for Pressure Piping.

- C. Inspections: Contractor to visually inspect piping while under hydrostatic pressure. Copies of inspection shall be submitted for review.
- D. Repair piping systems sections which fail required piping test, by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- E. Drain test water from piping systems after testing and repair work has been completed.
- F. Test pressure piping in accordance with ANSI B31.
- G. If test procedures in other sections differ from the above, comply with more stringent requirements.

END OF SECTION 230600



SECTION 231400 – MECHANICAL SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. This section is Division 23 Mechanical Supporting Devices section, and is part of each Division 23 section making reference to supports and anchors specified herein.
- C. Division 23 General Mechanical Requirements apply to work of this section.

1.2 SUMMARY:

- A. Extent of supports and anchors required by this section is indicated on drawings and/or specified in other Division 23 sections.
- B. Types of supports and anchors specified in this section include the following:
  - 1. Horizontal-Piping Hangers and Supports.
  - 2. Vertical-Piping Clamps.
  - 3. Hanger-Rod Attachments.
  - 4. Building Attachments and In-Beds.
  - 5. Saddles and Shields.
  - 6. Miscellaneous Materials.
  - 7. Roof Equipment Supports.
  - 8. Anchors.
  - 9. Equipment Supports.
- C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.
- D. Relate this section to Section 232400 regarding seismic and vibration control.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.
- B. Shop Drawings:
  - 1. Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of

assembly of components.

- C. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

## 1.5 REFERENCES:

### A. Codes and Standards:

1. Code Compliance: Comply with applicable building, mechanical and plumbing codes pertaining to product materials and installation of supports and anchors.
2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
3. MSS Standard Compliance:
  - a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
  - b. Select and apply pipe hangers and supports, complying with MSS SP-69.
  - c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
  - d. Terminology used in this section is defined in MSS SP-90.

## PART 2 - PRODUCTS

### 2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS:

- A. General: Except as otherwise indicated, provide factory-fabricated horizontal piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
- B. Adjustable Steel Clevises Hangers: MSS Type 1. (For suspension of non-insulated or insulated stationary pipe lines; 1/2" to 30".
- C. Steel Double Bolt Pipe Clamps: MSS Type 3. (For suspension of pipe requiring up to 4" of insulation and where flexibility of clamp is desirable; 3/4" to 24".
- D. Steel Pipe Clamps: MSS Type 4. (For suspension of cold pipe lines or hot lines where little or no insulation is required; 1/2" to 24".
- E. Pipe Hangers: MSS Type 5. (For suspension of piping when off-center closure allowing installation of hanger before erection of piping is desired; 1/2" to 4".
- F. Adjustable Swivel Pipe Rings: MSS Type 6. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".

- G. Adjustable Steel Band Hangers: MSS Type 7. (For suspension of non-insulated stationary pipe lines; 3/4" to 8".
- H. Adjustable Band Hangers: MSS Type 9. (For suspension of non-insulated stationary pipe lines; 1/2" to 8".
- I. Adjustable Swivel Rings, Band Type: MSS Type 10. (For suspension of non-insulated stationary pipe lines; 3/8" to 8".
- J. Split Pipe Rings: MSS Type 11. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".
- K. Extension Split Pipe Clamps: MSS Type 12. (For suspension of non-insulated stationary pipe lines; 3/8" to 3".
- L. U-Bolts: MSS Type 24. (For support of heavy loads; 1/2" to 30".
- M. Clips: MSS Type 26. (For support of uninsulated piping not subject to expansion or contraction.
- N. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange. (To support pipe from floor stanchion, using floor flange to secure stanchion to floor 4" to 36".
- O. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange. (To Type 36 except U-bolt provided for retaining pipe.

## 2.2 VERTICAL-PIPING CLAMPS:

- A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
- B. Two-Bolt Riser Clamps: MSS Type 8. (For support and steadying of pipe risers; 3/4" to 20". Also supports pipe covering or insulation.
- C. Four-Bolt Riser Clamps: MSS Type 42. (When longer ends are required for riser clamps.

## 2.3 HANGER-ROD ATTACHMENTS:

- A. General: Except as otherwise indicated, provide factory- fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
- B. Steel Turnbuckles: MSS Type 13. (For adjustment up to 6" for heavy loads.
- C. Steel Clevises: MSS Type 14. (For use on high temperature piping installations.

- D. Swivel Turnbuckles: MSS Type 15. (For use with split pipe rings, MSS type 11.
- E. Malleable Iron Sockets: MSS Type 16. (For attaching hanger rod to various types of building attachments.

2.4 BUILDING ATTACHMENTS AND IN-BEDS:

- A. General: Except as otherwise indicated, provide factory- fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
- B. Concrete Inserts: MSS Type 18. (For upper attachment for suspending pipe hangers from concrete ceiling.
- C. Top Beam C-Clamp: MSS Type 19. (Use under roof installations with bar joist construction, for attachment to top flange of structural shape.
- D. Side Beam or Channel Clamps: MSS Type 20. (For attachment to bottom flange of beams, channels, or angles.
- E. Center Beam Clamps: MSS Type 21. (For attachment to center of bottom flange of beams.
- F. Welded Beam Attachments: MSS Type 22. (For attachment to bottom of beams where loads are considerable and rod sizes are large.
- G. C-Clamps: MS Type 23. (For attachment to structural shapes.
- H. Top Beam Clamps: MSS Type 25. (For attachment to top of beams when hanger rod is required tangent to edge of flange.
- I. Side Beam Clamps: MSS Type 27. (For attachment to bottom of steel I-beams.
- J. Steel Beam Clamps with Eye Nut: MSS Type 28. (Same as Type 28 with link extensions.
- K. Linked Steel Clamps with Eye Nut: MSS Type 29. (Same as Type 28 with link extensions.
- L. Malleable Beam Clamps: MSS Type 30. (For attachment to structural steel.
- M. Steel Brackets: One of the following for indicated loading:
  - 1. Light Duty: MSS Type 31, to 570 pounds.
  - 2. Medium Duty: MSS Type 32, to 1,500 pounds.
  - 3. Heavy Duty: MSS Type 33, to 3,000 pounds.
- N. Side Beam Brackets: MSS Type 34. (For use on sides of steel or wooden beams.
- O. Plate Lugs: MSS Type 57. (For attachment to steel beams where flexibility at the beam is desired.

- P. Horizontal Travelers: MSS Type 58. (For supporting piping systems subject to linear horizontal movements where head room is limited.

**2.5 SADDLES AND SHIELDS:**

- A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
- B. Protection Saddles: MSS Type 39; see section Mechanical Insulation for void fill requirements. Use for roller supports and on all pipes 10" and larger.
- C. Protection Shields: See section Mechanical Insulation.
- D. Thermal Hanger Shields: See section Mechanical Insulation.
- E. Manufacturer; Subject to compliance with requirements, provide thermal hanger shields of one of the following:
  - 1. Elcen Metal Products Co.
  - 2. Pipe Shields, Inc.

**2.6 MANUFACTURERS OF HANGERS AND SUPPORTS:**

- A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
  - 1. Kin-Line, Inc.
  - 2. Fee & Mason Mfg. Co.; Div. Figgie International
  - 3. ITT Grinnel Corp.
  - 4. B-line
  - 5. Unistrut

**2.7 HIGH HUMIDITY AREAS:** Use cadmium plated or galvanized hangers, attachments, rods, nuts, bolts and other accessories in boiler rooms or other high humidity areas.

**2.8 OUTSIDE AREAS:** Use galvanized hangers, attachments, rods, nuts, bolts, and other accessories for all outside areas.

**2.9 MISCELLANEOUS MATERIALS:**

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
- C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2. Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration. Use Embeco grout for non-shrink applications.
- D. Heavy Duty Steel Trapezes: Fabricate from factory built channel (Unistrut) system and use factory fasteners for channel steel shapes, selected for loads required; weld steel in accordance with AWS standards.

- E. Pipe Guides: Provide factory-fabricated guides, of cast semi- steel or heavy fabricated steel, consisting of bolted two- section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

### PART 3 - EXECUTION

#### 3.1 INSPECTION:

- A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.2 PREPARATION:

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

#### 3.3 INSTALLATION OF BUILDING ATTACHMENTS:

- A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through the openings at the tops of inserts.

#### 3.4 INSTALLATION OF HANGERS AND SUPPORTS:

- A. General: Install hangers, supports, clamps and attachments to rigidly support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.
- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

- C. Prevent electrolysis in support of copper tubing by the use of hangers and supports which are copper plated, or by isolating with foam rubber covering or 30 mil insulating tape.
- D. Provisions for Movement:
  - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
  - 2. Install supports within 2 feet of non-vertical flex connectors.
- E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
- F. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.
- G. Insulated Piping: Do not allow hangers to come in contact with pipe where pipe is specified to be insulated.
- H. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
- I. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install galvanized steel protective shields. Install calcium silicate blocks (12" long minimum) at support points.
- J. Saddles: Where insulation without vapor barrier is indicated, install protection saddles.

### 3.5 INSTALLATION OF ANCHORS:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer for loading and stresses to connected equipment.
- B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- D. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

### 3.6 EQUIPMENT SUPPORTS:

- A. Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend a minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

- B. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

3.7 ADJUSTING AND CLEANING:

- A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.
- B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.
- C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 231400



**SECTION 231700 - MOTORS, DRIVES AND ELECTRICAL REQUIREMENTS FOR MECHANICAL WORK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

**1.2 SUMMARY:**

- A. This section specifies the basic requirements for motors and drives furnished by this Division and for electrical components which are an integral part of packaged mechanical equipment. Package components include, but are not limited to factory installed motors, starters, and disconnect switches, etc.
- B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are noted within these documents.

**1.3 QUALITY ASSURANCE:**

- A. Provide electrical components and materials which are UL labeled.
- B. Provide variable speed drives which conform to the latest standard of the following:
  - 1. IEEE - Institute of Electrical and Electronic Engineers.
  - 2. NEC - National Electrical Code.
  - 3. NEMA - National Electrical Manufacturers Association.
  - 4. Provide complete packaged unit(s) which are listed and carry the label of at least one of the following:
    - a. UL - Underwriters Laboratory
    - b. ETL - ETL Testing Laboratories, Inc.
    - c. CSA - Canadian Standards Association

**1.4 SUBMITTALS:**

- A. Submit complete product and application information for variable speed drives as follows:
  - 1. Provide multiple sets of drawings of system (VFD) being supplied, in strict compliance with the specifications. Include, as a minimum:
    - a. General arrangement of each unit showing size and incoming and outgoing conduit locations.
    - b. Schematic.
    - c. Connection diagram, sufficient to install drive system.
  - 2. Provide each unit with four owner/maintenance manuals which shall include:

- a. Vendor information of equipment being supplied.
  - b. Connection information.
  - c. Start-up procedure.
  - d. Fault reset instruction.
  - e. Wiring diagrams (power and control).
  - f. Parts list.
  - g. Test results.
  - h. Harmonic voltage distortion on line with unit off.
  - i. Harmonic voltage distortion with unit on line.
- B. Submit product data for motors, belts, drives, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections. Verify project electrical characteristics with submittal. Confirm suitability for altitude, maintaining full nameplate rating plus service factor. Include this data in maintenance manual in accordance with Division 23195 "Operation and Maintenance Manuals".

#### 1.5 REFERENCES:

- A. NEMA Standards MG 1: Motors and Generators.
- B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.
- C. NEMA Standards 250: Enclosures for Electrical Equipment.
- D. NEMA Standards KS 1: Enclosed Switches.
- E. Comply with National Electrical Code (NFPA 70).

#### 1.6 WARRANTY:

- A. General: Furnish a written warranty consisting of the following:
  1. Warranty parts and labor for five years after substantial completion.

### PART 2 - PRODUCTS

#### 2.1 MOTORS:

- A. The following are basic requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
  1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
  2. Motor sizes large enough so that the driven load will not require the motor to operate in the service factor range.
  3. Single speed motors of the permanent split capacitor type. (PSC)
  4. Temperature Rating: Minimum rate for 40°C environment with maximum 90°C temperature rise for continuous duty at full load (Class H Insulation for altitude, Class B leads allowed).

5. Starting Capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly timed spaced starts per hour for manually controlled motors.
6. Service Factor: 1.15 for poly-phase motors and 1.35 for single phase motors, 1.0 for TEFC motors.
7. Motor Construction: NEMA Standard MG 1, general Purpose, continuous duty, design "B", except "C" where required for high starting torque.
8. Frames: NEMA Standard No. 48 or 54; T-frame, use driven equipment manufacturer's standards to suit specific application.
9. Bearings:
  - a. Ball or roller bearings with inner and outer shaft seals;
  - b. Re-greasable, except permanently sealed where motor is normally inaccessible for regular maintenance;
  - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor;
  - d. For fractional horsepower, light duty motors, sleeve type bearings are permitted;
10. Enclosure Type:
  - a. Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation;
  - b. Weather protected type I for outdoor use, Type II where not housed;
11. Overload Protection: built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter.
12. Noise Rating: "Quiet"
13. Efficiency: "Energy Efficient" motors shall have a minimum efficiency as scheduled in accordance with IEEE Standard 112, test method B. If efficiency not specified, motors shall have a higher efficiency than "average standard industry motors", in accordance with IEEE Standard 112.
14. Nameplate: indicate the full identification of manufacturer. ratings, characteristics, construction, special features and similar information.
15. Acceptable Manufacturers: Baldor, General Electric, Reliance, U.S. Motors, Siemens, Toshiba, Washington Fieldstek, Allen-Bradley, AD Smith.

END OF SECTION 231700

**SECTION 231900 - MECHANICAL IDENTIFICATION**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods sections apply to work of this section.
- C. Cross reference Division 09 for basic painting requirements. Use this section to identify extent of painting for pipes, ducts, etc. and color coded identification.

**1.2 SUMMARY:**

- A. All plumbing, heating, air conditioning, automatic temperature control equipment (excluding thermostats and relays), and distribution systems shall be labeled. Include all fire damper, fire/smoke damper and smoke dampers. Electrical switches and starters for mechanical equipment shall also be labeled.

**PART 2 - GENERAL MECHANICAL MATERIALS AND METHODS**

**2.1 VALVE, AND PIPE IDENTIFICATION:**

**A. Valve Tagging:**

All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The Contractor shall furnish and install approved brass tags for all designated items, with numbers and letters on the tags corresponding to those on the charts and diagrams.

**1. Valve Identification:**

- a. All valves, regardless of size, shall have brass tags at least 1" by 3" in size and 0.051 inches thick. Legend on tag shall use engraved lettering at least 1/8" high. Each valve on the drawing shall be identified separately, and valve tags shall match the drawing identification.
- b. Valve tags shall include the following minimum information:
  - (1) Plan Identification
  - (2) Normal Position
  - (3) Duty
  - (4) Area Served
  - (5) Valve Type
- c. Tags shall be securely fastened to valves with steel rings or brass jack chain, in a manner to permit easy reading. Do not attach to valve wheel or the handle.

2. A chart of all valves shall be furnished as part of O & M Manual by the Contractor. Charts shall indicate the following items:
  - a. Valve identification number  
Location  
Service or purpose  
Normal position
  - b. One chart to be mounted in a frame with clear lexan front, and secured on a wall in the equipment room(s), or in a location as otherwise directed by the Architect.
  - c. Another chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at tope of plastic closure to allow for affixing approximately an 811 length of nickel plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plant Company, New Haven, Connecticut or equal.
  
3. Sample Identification Chart is as follows:

**VALVE IDENTIFICATION CHART**

Number	Description	Location*	Normal Position
1.	Cold Water Supply to Water Heater	Mech Rm #121	Open
2.	Hot Water Supply from Water Heater	Room #212	Open
3.	Heating Hot Water Balancing Above	Room #412	On Valve

\* The above room numbers shall be the room numbers actually used. DO NOT USE ARCHITECTURAL ROOM NUMBERS ON PLANS. Use institution actual assigned room numbers.

**B. Pipe Identification:**

1. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. This applies to piping run above the ceilings as well as pipe exposed in equipment rooms and finished areas. Pipes shall be identified at the following locations:
  - a. Adjacent to each valve
  - b. At every point of entry and exit where piping passes through a wall or floor.
  - c. On each riser and junction.
  - d. A maximum of every 50 feet on long continuous lines fully exposed to view. Less spacing if one cannot see one code from the adjacent.
  - e. Adjacent to all special fittings or devices (regulating valves, etc.)
  - f. Connection to equipment.
  
2. Apply markers so they can be read from floor. Labels and markers shall be of the self-sticking, all temperature, permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin; or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.
  
3. Identifying lettering shall be painted or stenciled on duct or pipe. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2" high for duct and larger

piping 3" or more, 1" high for 1-1/4" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.

4. Arrows to indicate direction of flow shall be painted in the same color as the lettering. The arrow shall point away from the lettering. On duct and large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
5. Pipe color coding shall be uniform throughout. Background colors shall be as follows:
  - a. Yellow: Dangerous Materials (high pressure steam, natural gas, condensate, high pressure refrigerant, high voltage, etc.)
  - b. Red: Fire Protection Equipment (fire sprinkler water, fire protection water).
  - c. Bright Blue: Protective Materials (filtered water).
  - d. Green: Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)

6. Piping and duct shall be identified with the following colors:

Abbreviation & Medium Lettering Color	Identifying Lettering	Pipe or Duct Color
Water:		
Domestic Cold Water	DCW	Green
Domestic Hot Water	DHW	Yellow
Domestic Hot Water Return	DHWR	Yellow
Heating Water Supply	HWS	Yellow
Heating Water Return	HWR	Yellow
Drain	Black	Black
Air:		
Supply Air	Supply Air	Painted on Duct
Exhaust Air	Exhaust Air.	or insulation with
Return Air	Return Air	arrow indicating
Outside Air	Outside Air.	direction of flow
		Black

7. Markers shall be installed in strict accordance with manufacturer's instructions.
  - a. On chalky and loose insulation, soft, porous, fiberfilled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.
  - b. On bare pipes, painted pipes, and pipes insulated with a firm covering pipe banding tape matching the background color of the marker shall be used for 360 color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or bonding tape.
8. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance. If stenciling is used,

letter heights, background colors, banding and arrows shall be as specified above. Submit samples before proceeding with work.

END OF SECTION 231900

**SECTION 231950 - OPERATION AND MAINTENANCE MANUALS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to work of this section.
- B. Division 23 General Mechanical Requirements sections apply to work of this section.

**1.2 SUMMARY:**

- A. Furnish four sets of bound operation and maintenance manuals. Manuals shall contain descriptive drawings and data which identify equipment installed at the project and detail the procedures and parts required to maintain and repair the equipment. Copies of approved submittals shall be included for all equipment.

**1.3 OPERATION AND MAINTENANCE MANUAL FOR MECHANICAL SYSTEMS:**

- A. General:
  - 1. The "Operating and Maintenance Manual" is a bound compilation of drawings and data that the owner requires for each building or project. These manuals, complete with drawings and data, shall be furnished to the Owner.
  - 2. The mechanical contractor has overall responsibility to obtain the necessary data and compile the data as set forth in this specification, including items or equipment purchased by the Owner and delivered to the contractor for installation.
  - 3. Make all information legible and sufficiently marked to indicate the exact size, model, type, etc., of equipment furnished and installed.
- B. Purpose: The Operating and Maintenance Manual is prepared to provide a ready reference to all important pieces of mechanical and electrical equipment installed on the project. It is also to provide the necessary operating and maintenance data for use by service personnel. It is also to provide information required for checking equipment performance or for planning of plant expansion or redesign.

**PART 2 - MATERIALS AND METHODS**

- 2.1 **PAGE SIZE:** All pages shall be standard 8-1/2 x 11 inches size or approximate multiples (preferably 16 x 11 inches) folded to 8-1/2 x 11 inch.
- 2.2 **DRAWINGS:** All drawings larger than 8-1/2" x 11" shall be folded and inserted in individual 8-1/2" x 11" manila pockets, which shall have standard three-ring side punching for insertion in the binders. The equipment name, drawing description and number shall be written on the face of each manila pocket.
- 2.3 **BINDERS:** Binders shall be 3 ring type for sheet size 8-1/2 x 11 inches. Binders shall contain a



place for cover and backbone inserts.

A. Place the following information on the front cover and backbone:

1. "Operation and Maintenance Manual".
2. Project Name.
3. Building name.
4. Architect's name.
5. Engineer's name.
6. General Contractor's name.
7. Mechanical Contractor's name.
8. Items 5 through 7 need not be printed on the backbone.

#### 2.4 CONTENTS AND INDEXING:

A. Manuals shall contain descriptions of the building systems in sufficient detail to adequately indicate the type of systems installed and the basic details of their operation.

B. All purchased equipment data shall be used to designate the sections. Within each section additional indexing of component parts may be required.

C. Operation and Maintenance Manuals shall contain to the fullest extent all possible information pertinent to the equipment. The arrangement and type of information to be filed shall be as follows:

1. Copy of purchase order change (if any).
2. Outline drawings, special construction details, as built electrical wiring and control diagrams for all major and supplementary systems.
3. Manufacturers test or calculated performance data and certified test curves.
4. Installation, operating, and maintenance instructions, including a complete parts list and sectional drawing with parts identification numbers. Mark with model, size and plan number.
5. Manufacturers brochure marked to indicate exact equipment purchased. Brochures on component parts supplied by a manufacturer with his equipment, but not manufactured directly by him, shall also be included.
6. The serial numbers of each item of equipment installed are to be listed with the model numbers and plan symbols.
7. Include a Table of Contents. The contents shall be divided with tabbed index dividers into the following suggested parts:
8. Part I Building and System Descriptions
9. Part II Purchased Equipment Data
10. Part III Test Reports.
11. Part IV Start-Up and Operation
12. Part V Preventative Maintenance Recommendations
13. A copy of all testing, adjusting and balancing reports.
14. Wiring diagrams, marked with model and size and plan symbol.
15. The index shall contain the name and address of the manufacturer and, if different, where replacement and repair parts may be obtained.

END OF SECTION 231950

SECTION 232500 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections apply to work of this section.
- B. Division 23, Section 230000 - General Mechanical Requirements applies to work of this section.

1.2 SUMMARY:

- A. Extent of mechanical insulation required by this section is indicated on drawings and schedules as required by the current Model Energy Code, and by requirements of this section. Use no asbestos in this work. Include restorations of insulations of damaged work including repair of damaged existing insulation due to new work.
- B. Types of mechanical insulation specified in this section include the following:
  - 1. Piping Systems Insulation:
    - a. Fiberglass.
    - b. Flexible Unicellular.
  - 2. Ductwork System Insulation:
    - a. Fiberglass.
    - b. Rigid flexible wrap.
  - 3. Equipment Insulation:
    - a. Fiberglass.
- C. Refer to Division 23 section "Mechanical Supporting Devices" for protection saddles, protection shields, and thermal hanger shields.
- D. Refer to Division 23 section "Ductwork" for duct linings.
- E. Refer to Division 23 section "System Identification" for installation of identification devices for piping, ductwork, and equipment.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets,

coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives and coatings to site in containers with manufacturer's stamp or label affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

**PART 2 - PRODUCTS**

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide mechanical insulation materials of one of the following (except as noted):
  - 1. Armstrong World Industries, Inc.
  - 2. Babcock and Wilcox Co., Insulating Products Div.
  - 3. CertainTeed Corp.
  - 4. Knauf Fiber Glass GmbH.
  - 5. Manville Products Corp.
  - 6. Owens-Corning Fiberglass Corp.
  - 7. Pittsburgh Corning Corp.

2.2 PIPING INSULATION MATERIALS:

- A. Preformed Fiberglass Piping Insulation: ASTM C 547. Class 1 for use to 450°F (230°C); Class 2 for use to 650°F (345°C); Class 3 for use to 1200°F (650°C).
- B. Flexible, Unicellular Pipe Insulation: Closed-cell elastomeric, preformed, with heat fusion or contact cement joining system. Insulation may be compressed but not stretched. By Armaflex II or Rubatex.
- C. All insulation exposed to sunlight or installed outdoors shall be protected with two coats of Armstrong Wb Armaflex Finish.
- D. Jackets for Piping Insulation: All purpose (ASJ) fire retardant jacket, ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.

- E. Encase pipe fittings insulation with one-piece premolded PVC fitting covers, fastened as per manufacturer's recommendations.
- F. Encase exterior fittings and insulation with aluminum jacket with weather-proof construction.
- G. Encase suction diffusers in a removable/replaceable insulating box.
- H. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- I. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
- J. Insulation Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- K. Thermal Hanger Shields: constructed of 360 degrees insert of high density, 100 psi, water-proofed calcium silicate, encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation.
  - 1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
    - a. Elcen Metal Products Co.
    - b. Pipe Shields, Inc.

### 2.3 DUCTWORK INSULATION MATERIALS:

- A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class 1 - 400°F (204°C); Class 2 - 400°F (204°C); Class 3 - 850°F (454°C); Class 4 - 1000°F (538°C); Class 5 - 1800°F (982°C); Class 1 - 10 lbs/ft<sup>3</sup>; Class 2, 3 and 4 - 12 lbs/ft<sup>3</sup>; class 5 - 20 lbs/ft<sup>3</sup>.
- B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type 1 - resilient, flexible; Class B-1 - 0.65 lbs/ft<sup>3</sup>; Class B-2 - 0.75 lbs/ft<sup>3</sup>; Class B-3 - 01.0 lbs/ft<sup>3</sup>; Class B-4 - 1.5 lbs/ft<sup>3</sup>; Class B-5 - 2.0 lbs/ft<sup>3</sup>; Class B-6 - 3.0 lbs/ft<sup>3</sup>; Type II - flexible; Class F-1 - 4.5 lbs/ft<sup>3</sup>; Type III - semirigid; Class F-2 - 4.5 lbs/ft<sup>3</sup>.
- C. Calcium Silicate Duct Insulation: ASTM C553, Type I, block or preformed sections. Rated assembly for greasehood exhaust duct enclosure.
- D. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.
- E. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- F. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

### 2.4 PIPING SEALANT THROUGH WALLS:

- A. Sealant shall be a two-part foamed silicone elastomer equal to Dow Corning 3-6548 Silicone RTV foam or equivalent by 3M or "Spec Seal" by STI. Sealant shall be applied at any piping of pipe or duct penetration through fire or smoke walls to prevent air from passing through the opening.
- B. Sealant cell structure, foamed in place, shall be U.L. classified and shall meet the smoke development and fuel contribution ratings specified. Sealant shall be stable at extreme temperatures, and shall effectively confine such hazards as fire, smoke and gases.
- C. Sealant required at any fire/smoke wall penetration to be according to approved detail for each specific wall assembly. Contractor shall submit detail for engineer approval.

**2.5 FIRE/SMOKE ENCASEMENT:**

- A. Any and all PVC, PVDF, polypropylene, acid waste and vent and any other plastic piping located in return air plenums shall be encased in rated flame and smoke system. The encasement shall be equal to Firemaster "Plastic Pipe Fire Protection System." The enclosure shall meet all codes.

**2.6 PIPE JACKETING:**

- A. Provide and install jacketing for all insulated pipe exposed in mechanical rooms. This in addition to standard foil on Kraft jacketing (ASJ).
  - 1. Domestic water, heating water, other insulated piping.
    - a. PVC sheets, 0.030" thickness.
    - b. PVC formed fitting covers.
    - c. Solvent welded joints and seams.
    - d. (Provide for removal and expansion.)
- B. All joints and seams caulked and sealed water tight.
- C. Color of jacketing selected by Owner.

**PART 3 - EXECUTION**

**3.1 GENERAL:**

- A. Piping insulation shall be fiberglass one-piece preformed pipe insulation, class related to temperature, with all purpose (ASJ) fire retardant jacket, additional jacketing as noted.
- B. Fittings and valves shall be insulated and covered with preferred Zeston (PVC) covers.
- C. All cold water, chilled water, roof drains or any other lines upon which condensate moisture could form, shall have a vapor-proof jacket.
- D. Fire and smoke hazard for a complete insulation system shall not exceed:
  - 1. Flame spread - 25
  - 2. Fuel contribution - 50
  - 3. Smoke development - 50

- E. Hangers shall not contact pipe where pipe is specified to be insulated. Insulation shall run continuous through the pipe hanger.

**3.2 INSPECTION:**

- A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.3 PLUMBING PIPING SYSTEM INSULATION:**

- A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions strainers check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, fire protection piping, and pre-insulated equipment.

- B. Cold Piping:

- 1. Application Requirements: Insulate the following cold plumbing piping systems:

- a. Potable cold water piping.
    - b. Plumbing vents within 6 lineal feet of roof or wall outlet.

- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

- a. Fiberglass with all service jacket, self sealing lap:
    - b. 1" thickness, taped and sealed joints.

- C. Hot Piping:

- 1. Application Requirements: Insulate the following hot plumbing piping systems:

- a. Potable hot water piping.

- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:

- a. Fiberglass with all service jacket, self-sealing lap: 1" thick for pipe sizes up to and including 6", 1-1/2" thick for pipe sizes over 6".

**3.4 HVAC PIPING SYSTEM INSULATION:**

- A. Insulation Omitted: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets provided piping is located over drain pan; on heating piping beyond control valve, located within heated space; on condensate piping between steam trap and union; and on unions, flanges, strainers, flexible connections, and expansion joints.

- B. Hot Pressure Piping (to 250°F):

- 1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 100 psi, water piping up to 200 degrees F).

- a. HVAC hot water supply and return piping, valves and fittings.
- 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
  - a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/4" through 4", 2" thick for pipe sizes over 5".
- C. Refrigerant Piping:
  - 1. Application Requirements: Insulate the following HVAC piping systems.
    - a. Refrigerant piping.
  - 2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
    - a. Closed cell elastomeric preferred insulation.
- D. Insulation of Piping Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing. Use only impermeable insulations (foam glass). Cover with aluminum jacketing 0.02" minimum thickness.

### 3.5 DUCTWORK SYSTEM INSULATION:

- A. Insulation Not Required: Do not insulate lined ductwork, except as noted, or exposed to weather.
- B. Hot, Cold and Dual Temperature Ductwork:
  - 1. Application Requirements: Insulate the following ductwork:
    - a. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet. Insulate neck and bells of supply diffusers.
    - b. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet: except omit insulation on return ductwork located in return air ceiling plenums.
  - 2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
    - a. Rigid fiberglass: Class 1, 1-1/2" thick, increase thickness to 2" in machine, fan and equipment rooms.
    - b. Flexible Fiberglass: Type 1, Class B-4, 1-1/2" thick, application limited to concealed locations.
- C. Duct Insulations:
  - 1. Wrap insulation snugly on the ductwork such that maximum thickness is maintained. Butt all circumferential joints and overlap longitudinal joints a minimum of 2". Adhere insulation with 4" strips of Insulation Bonding Adhesive, at 8" on center.

2. On circumferential joints, staple the 2" flange of the facing with 9/16" flare-door staples on 6" centers and taped with minimum 3" wide foil reinforcing Kraft tape. Tape all pin penetrations or punctures in the facing.

3.6 EQUIPMENT INSULATION:

A. Cold Equipment (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold equipment:
2. Roof drain bodies.
3. Factory insulated surfaces do not need to be field insulated.

B. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:

1. Fiberglass: 2" thick for surfaces above 35°F (2°C) and 3" thick for surfaces 35°F (2°C) and lower.

3.7 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on all pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Provide neatly beveled edge at all terminations and interruptions of insulation.
- I. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.
- J. Saddles and Shields:
  1. General: Except as otherwise indicated, provide protection saddles or thermal



hanger shields with protection shields under all piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and thermal shields for exact fit to mate with pipe insulation.

2. Protection Saddles: See section Supports and Anchors for saddle. Fill interior voids with segments of insulation matching adjoining insulation.
3. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation. Use on pipes 1-1/4" and smaller. Use with thermal hanger shields for pipes 1-1/2" and larger.
4. Thermal Hanger Shields: High density calcium silicate encased in 360 degrees sheet metal shield. Provide assembly of same thickness as adjoining insulation. Use on pipes 1-1/2" to 8".

### 3.8 INSTALLATION OF DUCTWORK INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- G. Ductwork Exposed to Weather: Protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.
- H. Corner Angles: Install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

### 3.9 INSTALLATION OF EQUIPMENT INSULATION:

- A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.
- D. Apply insulation using staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

- E. Coat insulated surfaces with layer of insulating cement, troweled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.
- F. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.
- G. Do not insulate over handholes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.
- H. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance: including metal vessel covers, fasteners, flanges, frames and accessories.

**3.9 PROTECTION AND REPLACEMENT:**

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during construction period to avoid damage and deterioration.

END OF SECTION 232500

**SECTION 236500 - REFRIGERATION PIPING AND EQUIPMENT**

**PART 1 - GENERAL**

**1.1 GENERAL MECHANICAL REQUIREMENTS**

- A. All pertinent sections of Section 230000 General Mechanical Requirements are a part of the work described in this section.
- B. All pertinent sections of Section 22 General Requirements for Plumbing and Piping are a part of the work described in this section.

**1.2 SUMMARY**

- A. This section specifies:
  - 1. Refrigeration piping systems and equipment for split type air conditioning systems.
  - 2. Piping, valves, specialties.

**1.3 STANDARDS**

- A. International Building Code/International Mechanical Code
- B. Local Codes and Ordinances
- C. State Pressure Vessel Regulations
- D. EPA Requirements.

**1.4 SHOP DRAWINGS/SUBMITTALS**

- A. Submit a list of all materials to be used indicating brand or source, type and service.
- B. Submit shop drawings for all equipment, valves and specialties, including shop drawing showing proposed pipe routing, sizing, valving, etc.

**1.5 CONTRACTOR QUALIFICATION**

- A. The Piping Contractor for this work shall be licensed as a firm in the Contractor state of origin and in the state of Utah.
- B. The Contractor shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
- C. All workmen employed in the project shall carry state licenses as journeyman or apprentice pipe fitters with additional certification for welders.

**1.6 SCOPE OF THE WORK**

- A. Furnish and install all field fabricated refrigeration systems and related work to effect a complete installation.

- B. Provide and install complete refrigeration piping systems and equipment for split air conditioning systems as indicated in the Contract Documents and as specified in this section. Make systems fully operational.
- C. Piping, valves, specialties.
- D. Other work indicated on the drawings.

1.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.
- B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.

1.8 WARRANTIES See Section 23.

PART 2 - MATERIALS AND METHODS

- 2.1 EQUIPMENT: All major items of refrigeration equipment shall be as specified in the equipment schedules on the drawings and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory operating system.
- 2.2 PIPING MATERIALS: Piping materials shall be as follows unless otherwise indicated on the applicable contract drawing:
  - A. Pipe: "ACR" Type L, hard drawing, degreased, sealed at mill copper tubing, ASTM B88-62, cleaned and sealed at the mill. Pre-charged refrigerant lines shall not be used.
  - B. Fittings: Long radius, wrought copper type equal to Mueller Streamline, ASME B16.22.1963.
- 2.3 VALVES, SPECIALTIES, ETC.
  - A. Filter-Dryer: On lines smaller than 3/4" O.D. filter-dryer shall be a sealed type using male flare fittings. Size shall be full line size. Filter-dryer shall be Sporlan, Mueller or Alco.
  - B. Sight Glass: Shall be a combination moisture and liquid indicator with protection cap. Sight glass shall be Alco, Mueller, Sporlan or Henry. Size shall be full line size.
  - C. Flexible Connection: Corrugated bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for system working pressure.
- 2.4 REFRIGERANT AND LUBRICATING OIL: The Contractor furnish and install all of the refrigerant required to develop the system to its full rating, and in addition to the initial charge, he shall be required to provide, without cost to the Owner, all required refrigerant for the proper operation of the refrigeration apparatus during the first year's operation. The contractor shall be required to provide the initial charge of lubricating oil for all refrigeration apparatus and related equipment. Loss of refrigerant and oil during the first year of operation shall be made good at the contractor's

expense.

2.5 SPLIT HEAT PUMP UNITS (FCU-1 & 2 & HP-1)

- A. Extent of Work Provide split type heat pump units, complete in all components as indicated on the drawings.
- B. Outdoor Condensing Units: Outdoor mounted, air cooled unit with hermetic or rotary compressor, air cooled coil and propeller type cooling fan.
  - 1. Cabinet: Cabinet shall be constructed of galvanized steel and finished with a baked enamel painting process. Unit access panels shall be removable and shall provide full access to all internal components.
  - 2. Fans: Outdoor fans shall be direct-drive propeller type with totally enclosed single phase motors with class B insulation and permanently lubricated sleeve bearings. Motor shall be protected by internal thermal overload protection.
  - 3. Compressor: Compressor shall be fully hermetic or scroll type compressor equipped with a complete oil system, operating oil charge and motor. Motor shall be equipped with internal overloads which protect the compressor from overtemperature and overcurrent. Scroll type compressors shall also be equipped with high discharge gas temperature protection.
  - 4. Outdoor Coil: Coil shall be constructed of seamless copper tubes mechanically bonded to aluminum fins.
  - 5. Refrigeration Circuit: Refrigerant circuit components shall include brass service valves and port connections, schrader type fittings with brass caps, accumulator, pressure relief, and a full charge of refrigerant.
  - 6. Safeties: The condensing unit shall contain the following safety circuitry and components.
    - a. Time delay restart to prevent short cycling.
    - b. Auto restart on power failure.
    - c. High and low pressure switches.
    - d. High pressure relief.
    - e. Outdoor fan failure protection.
  - 7. Accessories: Provide the following accessories.
    - a. Filter Dryer.
    - b. Sight Glass.
    - c. Support Feet.
    - d. Low Ambient Kit
    - e. Flex connections by anaconda.
- C. Indoor Fan Unit: Indoor ceiling mounted direct expansion unit with forward curved fan, cooling / heating coil, micro-processor based controls, and condensate pump in one cabinet.
  - 1. Cabinet: Cabinet shall be heavy gauge galvanized steel with fan, coil, filter and control sections. Cabinet shall be thermally and acoustically insulated to improve performance.
  - 2. Fans: Fans shall be fabricated of high impact polystyrene and shall be forward curved design for quiet operation. Fan motor shall be open drip proof permanently lubricated ball bearing type with inherent overload protection. Fan motors shall be 3 speed.

3. Coil: Coil shall be constructed of aluminum fins seamlessly bonded to copper tubes with galvanized steel tube sheets. A full length drip pan with manufacturers condensate pump shall be provided.
4. Controls: Controls shall be microprocessor based and shall control space temperature, determine optimal fan speed, and run self-diagnostics. The unit shall provide the following minimum control functions.
  - a. Automatic reset function after power failure.
  - b. 24-hour timer cycle for system auto start/stop.
  - c. High discharge air temperature shutdown shall be provided.
  - d. Indoor coil freeze protection.
  - e. Wireless infrared remote control.
  - f. Automatic air sweep control to provide equal air distribution to all areas.
  - g. Dehumidification mode shall be provided.
  - h. Fan only operation.
  - i. A time delay shall prevent compressor short cycling.

D. Approved Manufacturers:

1. Mitsubishi
2. Fujitsu
3. Carrier

**PART 3 – EXECUTION**

**3.1 INSTALLATION OF HEAT PUMP (HP-1)**

- A. General: Use best practices of the trade in all installation. Installation shall conform to the American Standard Code for Pressure Piping, ASME B31.5-1962, Refrigeration Piping. Installed piping shall not interfere with the operation and accessibility of doors or windows; shall not encroach on aisles, passageways, and equipment; and shall not interfere with the servicing or maintenance of equipment. Pipe shall be cut accurately to measurements established at the construction site and shall be worked into place without springing or forcing, properly clearing all openings and equipment. Cutting or weakening of structural members to facilitate piping installation is not permitted. Pipes shall have burrs removed by reaming and shall be so installed as to permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in a straight manner, free from traps, and shall be provided with capped or plugged ends, as it is erected, to prevent dirt from entering the system. The piping system shall be provided with isolating cushions, Unistrut P2600 Uni-Cushion at all hangers to prevent vibration and sound from being carried to the building structure.
- B. Slope of Refrigerant Lines: Slope suction lines down toward compressor 1" per 10 feet. Locate oil traps every 10 feet at all vertical rises against flow in suction lines. Suction line traps shall be standard one-piece traps.
- C. Cleanliness: All refrigerant lines and fittings shall be absolutely clean to avoid system operating difficulties and contamination. Use a good cleaning agent.
- D. Joints:
  1. Brazed joints: Tubing shall be cut square and burrs removed. Both inside of

- fittings and outside of tubing shall be well cleaned with steel wool, wire brush, or fine emery cloth before sweating.
2. An inert gas (such as oil pumped dry nitrogen) shall be continuously passed through the copper piping when brazing joints to prevent formation of copper oxide. Care shall be taken to prevent annealing of fittings and tubing when making connections. Joints shall be made with silver bearing brazing material.
- E. Vibration Isolation: Install condensing units on vibration isolation base noted on contract documents. Secure base securely to structure and secure condensing units securely to base. Install flexible connections just downstream of service valves and before sight glass and filter dryer.
- 3.2 TESTING OF REFRIGERATION PIPING SYSTEM: After the installation of the refrigeration piping system has been completed and before insulation is applied, all pipes shall be tested and proven tight for a period of 24 hours at a pressure of 300 pounds per square inch using oil pumped dry nitrogen.
- 3.3 EVACUATION AND CHARGING: After completion of the piping pressure test, the refrigeration systems shall be evacuated and dehydrated using a vacuum pump capable of producing at least 1 mm Hg absolute. The following procedure shall be followed unless otherwise noted:
- A. Connect an accurate high vacuum gauge, such as Stokes or Zimmeril gauge to the system.
  - B. Connect the vacuum pump to both the high and low side of the system. Leave the compressor suction and discharge service valves closed. Start the vacuum pump.
  - C. Keep ambient air temperatures above 60° during the evacuation process.
  - D. Operate the vacuum pump until the system is evacuated to 2.5 mg Hg absolute.
  - E. Break the system vacuum with oil pumped dry nitrogen. Open the compressor suction and discharge service valves and re-evacuate the system to 2.5 mm Hg absolute.
  - F. After the system has been double evacuated to 2.5 mm Hg absolute, close the vacuum pump suction valve and stop the pump. Allow the system to stand under a vacuum a minimum of 12 hours. If no noticeable rise in pressure has taken place after 12 hours, the system may be charged. This test shall be made in the presence of the Owner's representative.

END OF SECTION 236500

SECTION 238900 - DUCTWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods Sections apply to work of this section.

1.2 SUMMARY:

- A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork required for the project include the following:
  - 1. Round
  - 2. Rectangular
  - 3. Spiral
  - 4. Factory
- C. Exterior Insulation of metal ductwork is specified in other Division 23 sections, and is included as work of this section.
- D. Refer to other Division 23 sections for exterior insulation of metal ductwork; not work of this section.
- E. Refer to other Division 23 sections for ductwork accessories; not work of this section.
- F. Refer to other Division 23 sections for fans and rooftop units; not work of this section.
- G. Refer to other Division 23 sections for mechanical controls; not work of this section.
- H. Refer to other Division 23 sections for filters; not work of this section.
- I. Refer to other Division 23 sections for grilles and diffusers; not work of this section.
- J. Refer to other Division 23 sections for system commissioning, testing and balancing; not work of this section.

1.3 QUALITY ASSURANCE:

- A. **Manufacturer's Qualifications:** Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. **Installer's Qualifications:** A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.



1. The installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

**1.4 SUBMITTALS:**

- A. **Product Data:** Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.
- B. **Shop Drawings:** Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spacial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. **Record Drawings:** At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.
- D. **Maintenance Data:** Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

**1.5 REFERENCES:**

- A. **Codes and Standards:**
  1. **SMACNA Standards:** Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
  2. **ASHRAE Standards:** Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
  3. **NFPA Compliance:** Comply with NFPA 90A "Standard for the Installation of Air-Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning Systems".
  4. **International Building Code/ International Mechanical Code:** Comply with all sections pertaining to mechanical work.
- B. **Field Reference Manual:** Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

**1.6 DELIVERY, STORAGE, AND HANDLING:**

- A. **Protection:** Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. **Storage:** Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

**PART 2 - PRODUCTS**

**2.1 DUCTWORK - GENERAL:**

- A. Standards: All duct fabrications shall comply with standards and techniques detailed by SMACNA "Duct Construction Manuals" for the appropriate pressure class, and with the ASHRAE Handbook, 1988 edition, Chapter 1, Duct Construction
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 527, lockforming quality, with G 90 zinc coating in accordance with ASTM A 525; mill phosphatized for exposed locations.

## 2.2 FITTINGS AND FABRICATION:

- A. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° lateral and 45° elbows for branch take-off connections. Where 90° branches are indicated, provide conical type tees.
- B. Fittings: Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Fabricate elbows utilizing inside and outside radiuses with a center-line radius equal to associated duct width; or where fully radiused elbows are not possible, fabricate elbows with an inside square and outside radius and include turning vanes in the first 1/3 of elbow. Maintain duct width throughout turn on inside square and outside radiused elbows. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.
- C. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 section "Duct Accessories" for accessory requirements.
- D. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.
- E. Offset, transition, adapt ductwork to structural obstacles and work of other trades in a coordinated effort. Layout work to avoid conflict with piping, etc. With review of conditions, teardrop around conflicting piping, lights, etc., all at no added cost to the owner.

## 2.3 DUCT PRESSURE CLASSIFICATIONS:

- A. For all constant volume low pressure rooftop systems:
  - 1. Rectangular supply air and return air ductwork: Low pressure rectangular ductwork, 3" w.g.
  - 2. Branch round supply air ductwork runout from rectangular ductwork to diffuser: Low pressure round ductwork, 1" w.g.

## 2.4 LOW PRESSURE ROUND DUCTWORK: (1" SMACNA Pressure Class)

- A. Round type ductwork for use on low velocity supply systems (1200 fpm maximum), low pressure (0.75" maximum duct pressure), shall be fabricated on 26 gauge galvanized steel sheets with snap-lock longitudinal seams and crimped and beaded joints.
- B. All end joints shall have at least three screw fasteners and shall be wrapped airtight. Transverse and longitudinal seams shall be taped with "Hardcast TA". Snap lock longitudinal seams shall be seal with water based duct sealer **NO EXCEPTIONS**. Elbows and fittings shall provide smooth air flow patterns and have a neat appearance.

- C. Use factory fabricated elbows in lieu of the multi-sectional adjustable type.

**2.5 LOW PRESSURE RECTANGULAR DUCTWORK: (3" SMACNA Pressure Class)**

- A. Rectangular ductwork for use on supply systems up to 2" maximum duct static pressure and 2000 fpm maximum duct velocity shall be constructed of galvanized steel using construction for nominal 3" SMACNA rated systems. Seal all transverse and longitudinal joints with water based duct sealer NO EXCEPTIONS.
- B. Use radiused elbows, or square inside radiused outside elbows with single thickness turning vanes in the first 1/3 where space restrictions prohibit fully radiused elbows. Use 45° high efficiency tapping takeoffs with separate downstream balance dampers.
- C. Duct dimensions are inside clear. Increase for acoustical lining.
- D. For rectangular exhaust ducts, increase metal gauge by 2 (i.e. 20 to 18) for all sizes. Seal all joints.

**2.6 MEDIUM PRESSURE SPIRAL DUCTWORK**

- A. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gauges listed.

Diameter	Minimum Gauge	Method of Manufacture
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam

Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.

- B. Round Duct Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams. Mitered elbows shall be of at least 5 piece construction with R/D ratio of 1.5.

Diameter	Minimum Gauge
3" to 36"	20

**2.7 FACTORY DUCT:**

- A. Extent of Work: Provide factory duct at connections to air terminal units, at runouts to grilles and diffusers, at points of round to round flexible connections (see also "Flexible Connections") and at other locations indicated or required.
- B. Prohibited Material: Do not use single wire helix ducting with vinyl or plastic liner of any type.
- C. Factory Duct Non-corrosive Environments: Woven fiberglass fabric impregnated with vinyl or neoprene clamped in a continual helix of aluminum or cold rolled steel. U.L. listed for Class 1 duct, compliant with NFPA 90A and 90B, pressure rated to 12" w.g., equivalent to:

1. Non-insulated: Wiremold 57; Flexmaster Type N145
  2. Insulated: Flexmaster Type 4; Thermaflex M-KC
- D. Installation: Follow manufacturers instructions. Use stainless steel or nylon band clamping rings. In general, do not use lengths in excess of 1'-0". Do not make bends with factory duct, use hard elbows as indicated. Support duct to avoid droops and kinks. See details on the drawings.

## 2.8 MISCELLANEOUS DUCTWORK MATERIALS:

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Runout Fittings: Runout fittings shall be used to make round to rectangular duct connections. Use 45° time and a half square to round fittings. Provide with locking quadrant dampers where balance is involved. Provide with insulation guard where insulated duct is involved.
- C. Duct Sealing Compound: Duct sealing compound shall be 3M brand number EC-750, Duro-Dyne S-2 or Mon-Eco Industries 44-52. This material shall be used in making up duct joints or in water proofing, caulking plenums, etc.
- D. Acoustical Lining: Acoustical lining in ducts shall be 1" thick, 1-1/2 pound density, coated, flexible glass fiber type, set in adhesive and impaled on weld studs spaced not more than 12" on centers and secured with lock washers. Airstream surface faced with black coated matte. Acoustical lining shall completely line the ducts. Lining shall have a fire and smoke hazard rating not exceeding 20-50-50. Owens-Corning, Johns-Manville, Certainteed.
1. All joints, edges and/or surface breaks in the coating of the acoustical lining shall be pointed up to a smooth surface with adhesive.
- E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives and Duct Thermal Insulation".
- F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
- G. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/ installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

## PART 3 - EXECUTION

### 3.1 INSPECTION:

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner

acceptable to Installer.

### 3.2 INSTALLATION OF METAL DUCTWORK:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
1. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All of these changes, however, must be approved and installed as directed at project. During the installation, the open ends of ducts shall be protected to prevent debris and dirt from entering.
- B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- D. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures. Maintain clearances above of and in front of electrical panels.
- E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.
1. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate, in accordance with requirements of Section "Firestopping".
- F. Ducts at Structural and Architectural Penetrations: Where ducts are shown connecting to or passing through concrete, gypsum board, masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2-1/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal in these locations shall be bolted to the angle iron. Round high velocity ducts in vertical chases shall be supported with rolled angle rings. Close

openings between duct and structure.

- G. Cross Breaking: Rectangular sheet metal ducts shall be cross broken on the four sides of each 4-foot panel. All vertical and horizontal sheet metal barriers, duct offsets, elbows, as well as 4-foot panels of straight sections of ducts shall be cross broken. Cross breaking shall be applied to the sheet metal between the standing seams or reinforcing angles; the center of cross break shall be of the required height to assure surfaces being rigid.
- H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- I. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.
  - 1. Related to final installation cleanliness, damp wipe all ductwork on installation. Cap open duct ends, cover fan inlets, vacuum fan plenums and related installation before starting fans. Run fans only with filters in place.

### 3.3 INSTALLATION OF DUCT LINER:

- A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.
  - 1. As indicated on the drawings, supply, return and exhaust air ductwork shall be lined with acoustical insulation.
  - 2. In all cases outside air ductwork shall be lined with 2' thick 1-1/2 lb. density acoustical lining unless indicated differently on drawings, ie. requiring Type 2 plenum.

### 3.4 INSTALLATION OF FLEXIBLE DUCTS:

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 1'-0" extended length. No elbows allowed.
- B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible".

### 3.5 HANGERS AND SUPPORTS:

- A. Support all ductwork in accordance with SMACNA standards.

3.6 SUPPORTING DAMPERS: Parallel and opposed blade motor operated dampers shall be supported by reinforcing the ductwork or sheet metal walls at the damper locations to carry the weight of the dampers and the force exerted on the dampers due to air pressure, or shall be supported independent of ductwork from the ceiling or floor, as conditions at the site determine.

3.7 DUCT SEALING: Seal all tranverse joints and longitudinal seams with approved sealer. Apply sealer to all joints in layers, look to achieve a final thickness of 1/32" over the entire joint.

3.8 AESTHETIC LAYOUTS: Contractor shall locate all diffusers, grilles and other exposed items in such a manner as to fit symmetrically in any grid system or other aesthetic architectural or lighting pattern. Refer to reflected ceiling plans and electrical lighting layouts for additional information. Provide duct offsets or extensions as required to make a proper installation.

- A. Close or cap all duct ends. Use auxiliary blower with air flow meter to establish a duct pressure equivalent to the duct pressure class. Inspect all joints in duct system and seal all identifiable leaks.

**3.9 FIELD QUALITY CONTROL:**

- A. Leakage Tests: After each duct system which is constructed for duct classes over 3" is completed, test for duct leakage in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Air leaks which are in excess of that required to bubble the soap suds (that is, actually blow the suds away) shall be sealed by additional taping and caulking to reduce the leakage to a rate not to exceed slow bubbles forming. Repair leaks and repeat tests until total leakage conforms with Chart of Figure 4-1, Seal Class A, Leakage Class 3 for round/oval, 6 for rectangular.

**3.10 EQUIPMENT CONNECTION:**

- A. General: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

**3.11 ADJUSTING AND CLEANING:**

- A. Clean ductwork internally of dust and debris, as follows: Before the ceilings are installed, with filters in place, operate the fans at full capacity to blow out dirt and debris from ducts. If it is not practical to use the main supply blower for this test, the ducts may be blown out in sections by a portable fan.
- B. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- C. Balancing:
  - 1. Refer to Division 23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. However, the Sheet Metal Contractor shall participate fully in this work. Seal any leaks in ductwork that become apparent in balancing process.
  - 2. If specified conditions cannot be obtained due to deficiencies in equipment performance or improper installation or workmanship, the Mechanical Contractor and his subcontractors shall make any changes necessary to obtain the specified conditions.

END OF SECTION 238900

SECTION 239100 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 Basic Mechanical Materials and Methods sections apply to work of this section.

1.2 SUMMARY:

- A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of ductwork accessories required for project include the following:
  - 1. Dampers.
    - a. Low pressure manual dampers.
  - 2. Turning vanes.
  - 3. Duct hardware.
  - 4. Flexible connections.
- C. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.
- C. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

1.5 REFERENCES:

- A. Codes and Standards:



1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
4. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

1.6 DELIVERY, STORAGE AND HANDLING:

- A. Protection: Protect shop-fabricated and factory-fabricated accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
- B. Storage: Where possible, store accessories inside and protect from weather. Where necessary to store outside, store above grade and enclosed with waterproof wrapping.

PART 2 – PRODUCTS

2.1 MANUAL DAMPERS:

- A. Dampers for balance only where tight shutoff is not critical are to be furnished and installed by this Section.
  1. Exposed locations:
    - a. Honeywell D-640 (Rectangular), Honeywell D-690 (Round).
    - b. Ruskin CD-35 (Rectangular), Ruskin CDRS-25 (Round)
    - c. Johnson.

2.3 TURNING VANES: Turning vanes shall be single thickness blades with  $\frac{3}{4}$ " trailing edge. Blade spacing shall be per SMACNA and contract document details. Install turning vanes in the first 1/3 of all inside square elbows and extend vane runner past last blade and secure to duct

2.4 DUCT HARDWARE:

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
  1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, cover, for instrument tests. Ventlok No. 699 closures shall be provided and installed for each test hole, with sufficient neck length to penetrate the insulation.
  2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork. (Bare duct - Ventlok 620, 635; Insulated duct - Ventlok 627, 628, 637, 638, 629.)

- B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
  - 1. Ventfabrics, Inc.
  - 2. Young Regulator Co.

**2.7 FLEXIBLE CONNECTIONS:**

- A. Extent of Work: Provide flexible connections between ductwork or plenums and equipment, such as at fan inlets and discharges, and at other places indicated on the drawings or called for by note or specification.
- B. Non-Corrosive Environment or Airstream: Provide material of heavy waterproof woven glass fabric double coated with neoprene or hypalon equivalent to "Ventglas" for interior locations and "Ventlon" for exterior locations, fabric not less than 3-1/4" wide clamped between strips of 24 gauge galvanized iron. Material by Ventfabrics, Inc., Chicago, Ill.

**PART 3 - EXECUTION**

**3.1 INSPECTION:**

- A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

**3.2 INSTALLATION OF DUCTWORK ACCESSORIES:**

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install hand operated volume and splitter dampers at locations and of sizes shown. Volume dampers shall be controlled by heavy duty locking quadrants mounted on the outside of the duct. Where ducts are insulated, the damper rod shall be extended and the operator shall be mounted on the outside of the insulation. Where volume dampers are installed in ducts over 12" deep, the dampers shall be at least 1-1/2 times as long as the narrowest adjacent split, except where otherwise detailed. Splitter adjustment, accessible at face of finishing ceiling, or equal units by Young Regulator. Splitter dampers and butterfly dampers may be constructed by the Sheet Metal Contractor. All multi-blade hand dampers shall be the product of one of the manufacturers listed in the Contract Documents. All operator fittings shall be heavy duty commercial grade. . Test all hand dampers for operability immediately after installation. Dampers shall actuate from fully closed to fully open position with no binding or interference. Dampers found non-operable during Test and Balance will be repaired at the contractor's expense.
- C. Install turning vanes in the first 1/3 of all inside square outside radiused elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- E. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.3 FIELD QUALITY CONTROL:

- A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.4 ADJUSTING AND CLEANING:

- A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
  - 1. Final positioning of manual dampers is specified in Division 23 section "Testing, Adjusting, and Balancing".
  - 2. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION 239100

SECTION 239400 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SUMMARY:

- A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
  - 1. Ceiling air diffusers and grilles.
  - 2. Roof Caps
- C. Refer to other Division 23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.
- D. Refer to other Division 23 sections for balancing of air outlets and inlets; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: A firm with at least 3 years of successful installation experience on projects with metal ductwork systems work similar to that required for project.
  - 1. The Installer shall have a publicly registered bonding capacity of sufficient amount to cover this work and all other work in progress by the Contractor.
  - 2. All workmen on the project shall carry state licenses as journeymen or apprentice sheet metal workers with additional certification for welders.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
  - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
  - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
  - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

- B. Samples: 3 samples of each type of finish furnished.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.
- D. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

1.5 REFERENCES:

- A. Codes and Standards:
  - 1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
  - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
  - 3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
  - 4. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
  - 5. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
- B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 GRILLES AND DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

- D. Adjust all grilles and diffusers to fit neatly in the room ceiling pattern. Set final locations per architectural reflected ceiling plans.
- E. Volume Control Dampers: Provide duct mounted dampers of the externally adjustable opposed blade type where more than one grille or register is on a common duct. Provide access to each damper adjustment.
- F. Sound Level: The diffuser or grille generated noise shall not exceed the following sound power level curve at a point five feet away from the diffuser or grille.

Meeting Rooms: NC 25-30  
Court Rooms: NC 20-25  
Office Areas: NC 25-30

- G. Fire Dampers: Install fire dampers or smoke/fire dampers at the diffusers, registers and grilles as indicated on drawings or required by code.
- H. Manufacturers: Subject to compliance with requirements, provide grilles and diffusers of one of the following:

- |                  |                                |
|------------------|--------------------------------|
| 1. Hart & Cooley | 7. Tuttle & Bailey             |
| 2. Krueger       | 8. Anemostat/Waterloo          |
| 3. J and J       | 9. Agitair                     |
| 4. Carnes        | 10. Environmental Air Products |
| 5. Titus         | 11. Nailor                     |
| 6. EH Price      |                                |

- I. Types: Provide grilles and diffusers of type, capacity, and with accessories and finishes as listed on grille and diffuser schedule and as specified herein.

J. Grilles and Diffusers:

- 1. Ceiling Supply Diffuser (S-1): Krueger Series 1400A with adjustable tabs for directional air flow control, square face, round neck, four-way deflection, anti-smudge design, removable inner core, all steel construction, appropriate mounting frame, white baked enamel finish, sponge rubber gasket, size as indicated on drawings.
- 2. Ceiling Supply Diffuser (S-2): Krueger series DMGDR, heavy duty steel construction, double deflection blades, optional damper/extractor, duct mounted with sponge rubber gasket, anti-smudge design, white baked enamel finish, size as indicated on drawings.
- 3. Perforated Return Grille (R-1): Krueger series 6490. Concealed hinge frame, sponge rubber gasket, white baked-on enamel, color as selected by architect, size as indicated on drawing.
- 3. Sidewall Return Register (TG-1): Krueger series S80H. Heavy duty steel construction, Horizontal blades at 0° deflection with 1/2" spacing, mounting frame with concealed fasteners, sponge rubber gasket, white baked enamel finish, size as indicated on drawings.

2.1 ROOF CAPS:

- A. Spun aluminum gravity roof ventilators shall be manufactured of heavy gauge aluminum utilizing spinning techniques to prevent warping inherent with drawing processes. The hood of the unit shall be easily removable for access to components beneath the ventilator. The base shall incorporate an integral spun inlet and shall be fully welded at

the corners to ensure a weather-tight installation. Provide with birdscreen, roof curb, and gravity backdraft damper.

- B. Manufacturers: Subject to compliance with requirements, provide exhaust roof caps of one of the following:
  - 1. Cook (Type PR)
  - 2. Greenheck
  - 3. Penn

### PART 3 – EXECUTION

#### 3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION:

- A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

END OF SECTION 239400

SECTION 239550 - MECHANICAL CONTROL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.
- B. Division 23 General Mechanical Requirements sections apply to work of this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of control systems work required by this section is indicated on drawings and schedules, and by requirements of this section.
  - 1. See following sections for types of Control Systems included as a part of this section. See electrical, etc.
  - 2. Control sequences are specified in this section under: "Sequence of Operation".
- B. Refer to other Division 23 sections for installation of dampers in mechanical systems.
- C. Refer to Division 26 sections for the following work.
  - 1. Power supply wiring from power source to power connection on controls and/or unit control panels. Includes starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.
  - 2. Interlock wiring between electrically-operated equipment units; and between equipment and field-installed control devices.
    - a. Interlock wiring specified as factory-installed is work of this section.
- D. Provide the following electrical work as work of this section, complying with requirements of Division 26 sections:
  - 1. Control wiring between field-installed equipment, controls, indicating devices, and unit control panels. All control wiring shall be in conduit.
  - 2. 120 volt service required by control systems.
- E. Participate in "System Commissioning, Testing and Balancing".

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: The HVAC controls shall be electric/electronic type
- B. Installer's Qualifications: Firms and workmen specializing and experienced in electric control system installations for not less than 5 years.
- C. Codes and Standards:
  - 1. Electrical Standards: Provide electrical products which have been tested, listed



- and labeled by UL and comply with NEMA standards.
2. NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.
  3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
  4. Comply with NEPA 70, "National Electric Code" for all electrical installation.

1.4 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.
- B. Shop Drawings: Submit shop drawings for each control system, containing the following information:
  1. Schematic flow diagram of system showing furnace, condensing unit, roof top unit, dampers, and control devices.
  2. Label each control device with setting or adjustable range of control.
  3. Indicate all required electrical wiring. Clearly differentiate between portions of work that are factory-installed and portions to be field-installed. Note contract responsibility to provide complete system regardless of delegation. Completely interface with and show existing installation in the Administration building.
  4. Provide details of faces of control panels, including controls, instruments, and labeling.
  5. Include verbal written description of sequence of operation. Confirm correct function of proposed sequences.
- C. Samples: Submit sample of each type of proposed thermostat cover to ensure they match existing.
- D. Maintenance Data: Submit maintenance instructions and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Section 231950.

1.5 DELIVERY, STORAGE, AND HANDLING: Provide factory shipping cartons for each piece of equipment, and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

1.6 INSTRUCTION OF OWNER'S PERSONNEL: (See Section 230000)

- A. Purpose is to provide a transition of the systems from the Contractor to the Owner, leaving the Owner's personnel familiar with and well qualified to operate and maintain the systems.
- B. Instruction to cover purpose and function of each system and its components, to show proper operating technique, to show proper maintenance technique.
- C. Prepare an outline of information to be conveyed, list materials available for reference. Submit to Architect along with a proposed schedule of instruction. Schedule to allow individual time for each trade and each system.

- D. Convey information in formal classroom session. Teachers to include qualified contractor personnel and sales representatives for each major piece of equipment. Go from the classroom to the actual location to graphically illustrate concepts discussed.
- E. Each and every session shall be video taped by the Contractor and given to the Owner.

**1.7 WARRANTIES:**

- A. As part of the overall project warranty, furnish individual manufacturer warranties for each piece of equipment for a period of not less than one year from date of Owner's beneficial use (substantial completion).
- B. Warrant the overall assembly of equipment, materials and labor comprising these systems.

**1.8 CLEANING AND LUBRICATION:** All instruments, and control panels shall be thoroughly cleaned before final acceptance.

**1.9 TESTING AND ADJUSTING OF SYSTEM:**

- A. During the system commissioning, testing and balancing of the various building systems, have a controls representative(s) present and available to interpret and adjust controls as needed. Demonstrate and report the integrity and accuracy of each function and control point.
- B. At the termination of the testing period, the Controls representative shall spend a minimum of 4 hours instructing the Owner's operating personnel in the control system operation, and checking each system for day-night and manual override with the Owner's operating personnel on each furnace system. A complete operating booklet shall be provided and used during the training period. Schedule this training with the Owner and Mechanical Contractor.
  - 1. Since system performance is partly a function of climatic conditions, the Controls contractor shall be available during the changing seasons of the warranty period to make further adjustments and modifications if required. A final complete check of all systems shall be made at the conclusion of the one year warranty period.

**PART 2 - PRODUCTS**

**2.1 CONTROL CABINETS:** Furnish stamped steel with hinged door and locking latch control cabinets to protect and conceal all control devices. Arrange components neatly to provide adequate maintenance opportunity and proper device function. Label all components, numerically code all piping and wiring. Terminate all wiring at terminal blocks. Provide engraved plastic labels for all panel face devices.

- A. Provide with fuse - quantity as required.
- B. Provide with transformer 120/24 VAC quantity as required.

**2.2 CONTROL DAMPERS:**

- A. In supplying dampers, instruct the sheet metal workers in the proper installation of the dampers. Ductwork shall be reinforced and the damper properly supported without strain.
- B. Protect all dampers mounted in a duct system which requires special treatment.
- C. Provide damper operators with motors of proper size, so that the motors will operate against the static pressure of the systems. Provide each damper motor with a bracket for attaching to ductwork, building structure or equivalent. Damper motors in plenums shall be mounted on damper frames. Do not install motors in ducts. Modulating motors where indicated shall be provided with integral steps for both minimum and maximum stop.
- D. Control dampers for outside air, relief air, exhaust air, ventilating air and other dampers exposed to weather temperatures in built-up systems. Low leakage type with spring loaded side seals, inflatable butyl or neoprene fabric edge seals, bronze or teflon bearings, reinforced galvanized steel blades. Parallel action. Air leakage not to exceed 10 CFM per square foot at 4" upstream static pressure.
  - 1. Johnson "Proportion-Aire" D-1200/D-1300.
  - 2. Ruskin CDR-25
  - 3. Greenheck VCD-43

#### 2.4 TRANSFORMER

- A. 120/24 volt, 38VA Honeywell AT72D1188, cover mount
- B. 120/24 volt, 50VA Honeywell AT87A1106, foot mount

#### 2.5 DAMPER ACTUATORS

- A. Electric type equipped for Class I wiring.
- B. Shall not consume power during UNOCCUPIED cycle or use chemicals or expandable media.
- C. Have built in spring return.
- D. Approved Manufacturer & Model –
  - 1. Belimo LF-24

#### 2.6 CONDUCTORS

- A. Color coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
- B. Thermostat Cable - 12 conductor or 8 conductor, 18AWG solid copper wire, insulated with high density polyethylene. Conductors parallel enclosed in brown PVC jacket (No 22 AWG cable allowed).

#### 2.7 AUXILIARY RELAYS

- A. Light Duty - as required.
- B. Heavy Duty - Square D, Class 8501, Type X.

**PART 3 - CONTROL SEQUENCES**

**3.1 GENERAL:**

- A. Provide control systems to manage and manipulate mechanical equipment in a functional and energy conserving way.
- B. Locate control panels in the mechanical rooms with terminal block connections for interface of rooftop systems, etc.

**3.2 ROOFTOP HEAT PUMP (RHP-1 & 2):**

- A. **ROOFTOP HEAT PUMP CONTROL:** The DDC system energizes the fan section of the unit whenever the building is occupied based on a schedule dictated by the owner. Upon a drop in the average space temperature to below setpoint the DDC system energizes the rooftop heat pump reversing valve and compressor and provides heat to the spaces. As the zone temperature reaches setpoint the DDC system disengages the reversing valve while the fan section continues to run. Upon a rise in the average space temperature to above setpoint the DDC energizes the rooftop heat pump condensing section and provides cooling to the spaces. As the zone temperature reaches setpoint the DDC system disengages the condensing section while the fan section continues to run.

**3.3 AIR HANDLING UNIT (AHU-1):**

- A. Adapt existing control devices and replicate existing control sequence for the new air handling unit.

**END OF SECTION 239550**

SECTION 239650 - ELECTRICAL CONTROL SYSTEMS

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS: See Division 23 "Mechanical Control Systems".
- 1.2 SUMMARY:
  - A. Electric control functions and systems indicated on the drawings and specified herein.
  - B. Complete interrelationships with pneumatic-control systems, automation systems and mechanical equipment.
- 1.3 QUALITY ASSURANCE: See Division 23 "Mechanical Control Systems".
- 1.4 SUBMITTALS: Division 23 "Mechanical Control Systems".
- 1.5 DELIVERY, STORAGE AND HANDLING: Division 23 "Mechanical Control Systems".
- 1.6 INSTRUCTION OF OWNER'S PERSONNEL: Division 23 "Mechanical Control Systems".

PART 2 – MATERIALS AND METHODS

- 2.1 ELECTRICAL POWER SUPPLY:
  - A. Obtain power from existing Division 26 panel. Furnish appropriate circuit breakers and extend conduit and wiring assigned to this division.
  - B. Furnish and install UL listed voltage reducing transformers required for this work. Size transformers to see no more than 70% of rated capacity at full load.
  - C. Make all electrical installations in conformance with the National Electrical Code (current edition) and in accordance with Division 26.
  - D. Use same product lines for similar devices as used by Division 260000 to result in a coherent project.
  - E. Control Wiring
    - 1. Provide plenum rated control cabling to match existing which is compatible with the existing control system.
    - 2. Number and code all wiring.
  - F. Use no wire smaller than 18 gauge.

PART 3 - INSTALLATION

- 3.1 CLEANING AND LUBRICATION: Division 23 "Mechanical Control Systems".
- 3.2 TESTING AND ADJUSTING OF SYSTEM: Division 23 "Mechanical Control Systems".

END OF SECTION 239550

SECTION 239700 – DDC CONTROL SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. The DDC Controls Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified for all new equipment, adapt existing controls to new equipment where indicated. The system shall include all required computer programming, software and license upgrades, hardware, controllers, sensors, transmission equipment, connection to existing workstations, local panels, conduit, wire, installation, engineering, database and setup, supervision, commissioning, acceptance test, training, warranty service and, at the owner's option, extended warranty service.
- B. The system shall only employ BACnet or Lontalk communications in an open architecture with the capabilities to support a multi-vendor environment. The system shall be capable of integrating third party systems and utilizing the following standard protocols.
  - 1. BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001.
  - 2. OPC server communications according to OPC Data Access 2.0 and Alarms and Events 1.0.
  - 3. LonWorks communication using LonTalk protocol.
  - 4. Modbus communication for integration to third party devices.
- C. The DDC System shall be web based and shall provide total integration of the facility infrastructure systems with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.
- D. The DDC System shall demonstrate, with (3) proof sources, integration with HVAC industry open standard protocols, including LonMark, BACnet, ModBus, OPC and Internet standard SQL database and HTTP / HTML / XML text formats.
- E. The DDC System shall communicate to third party systems such as VFD's, boilers, air handling systems, other energy management systems, access control systems, fire-life safety systems and other building management related devices using any of the open, interoperable communication protocols referenced in Paragraph D.
- F. All materials and equipment used shall be standard components, regularly manufactured with standard part numbers and owner's manuals for this and/or other systems. One of a kind, third party or custom integrations devices designed especially for this project will not be allowed.

1.2 RELATED SECTIONS:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Products furnished but not installed under this section:

1. Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under section 230000.
2. Automatic dampers to be installed under section 230000.

C. Coordination with electrical:

1. Installation of all line voltage power wiring by Division 26.
2. Each motor starter provided under Division 26, shall be furnished with individual control power transformer to supply 120 volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

1.3 QUALITY ASSURANCE

- A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- B. At the time of bid, all DDC System Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:
1. Underwriters Laboratory, UL 916
  2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

- A. Submit 4 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
  2. Equipment data cut sheets
  3. System schematics, including:
    - a. sequence of operations
    - b. point names
    - c. point addresses
    - d. point to point wiring
    - e. interface wiring diagrams
    - f. panel layouts
    - g. system riser diagrams
  4. AutoCAD® compatible as-built drawings.
  5. ATC Submittals shall be completed using HVAC Solution Software. AutoCAD files will be accepted on components and systems which HVAC Solution does not support. The main Bulk of the submittals shall be submitted using HVAC Solution.
- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
1. Index sheet, listing contents in alphabetical order
  2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
  3. Description of sequence of operations
  4. As-Built interconnection wiring diagrams
  5. User's documentation containing product, system architectural and programming information.

6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
8. Conduit routing diagrams
9. Copy of the warranty/guarantee
10. Operating and maintenance cautions and instructions
11. Recommended spare parts list

## **PART 2 – PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Delta Control (must integrate with existing Siemens Controls)
- B. Invensys by Yamas Controls (must integrate with existing Siemens Controls)
- C. Johnson Controls (must integrate with existing Siemens Controls)
- D. Siemens Building Technologies
- E. Staefa Control System (must integrate with existing Siemens Controls)
- F. Andover by Utah Controls (must integrate with existing Siemens Controls)

2.2 The DDC Control System shall be comprised of a network of interoperable, stand-alone digital controllers. The DDC System shall incorporate LonWorks technology using Free Topology Transceivers (FTT-10), or BACnet MSTP485 or Ethernet in all unitary, terminal and other device controllers. The system shall include:

- A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions.
- B. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions.
- C. Application Specific Controllers (ASC's) for control of VAV terminal units, Fan coil terminal units, Unit Vent terminal units, Heat Pump units and other terminal equipment.
- D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.

2.3 The controller network shall use twisted pair wiring or loop. The PEC and ASC network shall communicate at a minimum 78Kbps using BACnet or Lontalk. The GUI and NAC shall reside on an Ethernet backbone.

2.4 All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices.

### **2.5 NETWORK AREA CONTROLLER (NAC)**

- A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
  1. Calendar functions



2. Scheduling
  3. Trending
  4. Alarm monitoring and routing
  5. Time synchronization
  6. Integration of LonWorks controller data
  7. Integration of BACnet and MODBUS networks
- C. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
- D. The NAC shall support standard Web browser access via the Intranet/Internet. It shall be capable of supporting multiple users, expandable to fifty.
- E. The NAC shall provide alarm recognition, storage, routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
  2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
    - a. To alarm
    - b. Return to normal
    - c. To fault
  3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
  4. Provide timed (schedule) routing of alarms by class, object, group, or node.
  5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- F. Alarms shall be annunciated in any of the following manners as user defined:
1. Screen message text
  2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
    - a. Day of week
    - b. Time of day
    - c. Recipient
  3. Pagers via paging services that initiate a page on receipt of email message
  4. Graphic with flashing alarm object(s)
  5. Printed message, routed directly to a dedicated alarm printer
  6. Cell phones
- G. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
  2. Location (building, floor, zone, office number, etc.)
  3. Equipment (air handler #, access way, etc.)
  4. Acknowledge time, date, and user who issued acknowledgement.
- H. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- I. A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user.

- J. Provide a “query” feature to allow review of specific alarms by user defined parameters.
- K. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.
- L. An Error Log to record system errors shall be provided and available for review by the user.
- M. Data Collection and Storage
  - 1. The NAC shall collect data for any property of any object and store this data for future use.
  - 2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
    - a. Designating the log as interval or deviation.
    - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
    - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
    - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
    - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
  - 3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a standard Web Browser.
  - 4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
  - 5. All log data shall be available to the user in the following data formats:
    - a. HTML
    - b. XML
    - c. Plain Text
    - d. Comma or tab separated values
  - 6. The NAC shall have the ability to archive it’s log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
    - a. Archive on time of day
    - b. Archive on user-defined number of data stores in the buffer (size)
    - c. Archive when buffer has reached its user-defined capacity
- N. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached it’s user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
  - 1. Time and date
  - 2. User ID
  - 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- O. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time of day.
  - 1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.

2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

## 2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

- A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.
- B. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2001 or Lonworks FT110.
- C. The PEC must communicate peer-to-peer with all of the network application specific, programmable controllers and third party LonMark devices.
- D. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
- E. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
- F. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- G. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
- H. Each PEC shall support firmware upgrades without the need to replace hardware.
- I. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.
- J. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
  1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
  2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime and re-load time.
- K. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.

**2.7 APPLICATION SPECIFIC CONTROLLERS (ASC)**

- A. Each Application Specific Controller (ASC) shall operate as a stand-alone Lon Mark or BacNet controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.
- B. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power.
- C. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.
- D. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.
- E. After a power failure the ASC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

**2.8 GRAPHICAL USER INTERFACE SOFTWARE (GUI)**

- A. Provide programming time to display new units on existing graphics.

**2.9 WEB BROWSER CLIENTS**

- A. Provide programming time to display new units on existing graphics.

**2.10 PROJECT SPECIFIC WEB PAGES:**

- A. Provide programming time to display new units on existing graphics. New graphics shall match existing, except provide any additional points indicated on the drawings.

**2.11 FIELD DEVICES**

- A. Provide automatic control valves, automatic control dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.

**B. TEMPERATURE SENSORS**

- 1. Temperature Sensors: Temperature sensors shall be linear precision elements with ranges appropriate for each specific application.
- 2. Space (room) sensors shall be supplied with set point adjustment and override switch.
- 3. Duct mounted averaging sensors shall utilize a sensing element incorporated in a copper capillary with a minimum length of 20 feet. The sensor shall be installed according to manufacture recommendation and looped and fastened at a minimum of every 36 inches.

4. Sunshields shall be provided for outside air sensors.
  5. Thermo-wells for all immersion sensors shall be stainless steel or brass as required for the application.
- C. Pressure Transmitters: Differential or Gauge (static) Pressure Transmitters shall be solid state capacitance type. Transmitters shall have an output of 4 to 20 MA DC or 0-5 volts in accordance with ISA Standard 550.1 and shall operate from a power supply of 15 to 35 volts DC. Total affects of hysteresis, linearity and repeatability shall be plus or minus 1.0 percent of full scale or less, and repeatability shall be less than 0.3 percent of full scale. Variations in output signal per input supply voltage shall not exceed 0.02 MA output per 1.0 volt input change. The transmitters shall be totally enclosed, and shall have factory set zero and span adjustments that are accessible without removing the cover. Transmitters shall not be damaged by pressures at five (5) times the full scale pressure and shall be selected for the appropriate pressure range. Provide transmitters with LCD readout.
- D. SWITCHES AND THERMOSTATS
1. The DDC System Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.
  2. Duct Smoke Detectors: Duct smoke detectors shall be supplied by others with an integral auxiliary contact to be used by the DDC System Contractor to provide a digital input to the DDC System .
  3. Low Temperature Detection Thermostats: Shall be the manual reset type. The thermostat shall operate in response to the coldest one-foot length of the 20-foot sensing element, regardless of the temperatures at other parts of the element. The element shall be properly supported to cover the entire downstream side of the coil with a minimum of three loops. Separate thermostats shall be provided for each 25 square feet of coil face area or fraction thereof.
  4. Pressure Switches: Pressure Switches shall have a repetitive accuracy of plus or minus 2 percent of the operating range. Pressure Switches shall be the diaphragm type with adjustable actuation over the operating range. The switches shall have snap action form C SPDT or DPDT contacts rated for the application.
  5. Current Sensing Relays: Hawkeye Series 700, status switch capable of sensing a broken belt.
  6. Flow Switches: Motor status indications, where shown on the plans, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.

## 2.12. INSTALLATION

1. Installation shall be the responsibility of the mechanical contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.
2. The electrical contractor shall complete power wiring. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

## 2.13. START-UP

1. 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.

**2.14. PRODUCT SUPPORT**

1. Factory trained application engineering and service personnel that are thoroughly familiar with the SED2 drive products offered will be locally available at both the specifying and installation locations.

**2.15. WARRANTY**

1. Warranty shall be 24 months from the date of shipment (with certified start-up).

**PART 3 – EXECUTION**

**3.1 PROJECT MANAGEMENT**

- A. Provide a project manager who shall, as a part of his duties, be responsible for the following activities:
  1. Coordination between the Controls Contractor and all other trades, Owner, local authorities and the design team.
  2. Scheduling of manpower, material delivery, equipment installation and checkout.
  3. Maintenance of construction records such as project scheduling and manpower planning and AutoCAD or Visio for project co-ordination and as-built drawings.
  4. Coordination/Single point of contact

**3.2 INSTALLATION METHODS**

- A. Install systems and materials in accordance with manufacturer's instructions, rough-in drawings and equipment details. Install electrical components and use electrical products complying with requirements of applicable Division-16 sections of these specifications.
- B. The term "control wiring" is defined to include providing of wire, conduit, and miscellaneous materials as required for mounting and connecting electric or electronic control devices.
- C. To run BACnet on the ethernet network, the installer is required to run, at minimum, plenum rated CAT 5e cabling for all runs associated with this network.
- D. All exposed wiring, low and line voltage subject to mechanical damage, shall be run in conduit. Line and low voltage wiring shall be run in separate conduits. Concealed but accessible wiring, except in mechanical rooms and areas where other conduit and piping are exposed shall run in UL plenum rated cable as approved by local codes unless expressly restricted by requirements in Division 16 specification.
- E. All Controllers, Relays, Transducers, etc., required for stand-alone control shall be housed in a NEMA 1 enclosure with a lockable door.

**3.3 SYSTEM ACCEPTANCE**

- A. General: The system installation shall be complete and tested for proper operation prior to acceptance testing for the Owner's authorized representative. A letter shall be submitted to the Architect requesting system acceptance. This letter shall certify all controls are installed and the software programs have been completely exercised for proper equipment operation. Acceptance testing will commence at a mutually agreeable time within ten (10) calendar days of request. When the field test procedures have been demonstrated to the Owner's representative, the system will be accepted. The warranty period will start at this time.
- B. Field Equipment Test Procedures: DDC control panels shall be demonstrated via a functional end to end test. Such that:
  - 1. All output channels shall be commanded (on/off, stop/start, adjust, etc.) and their operation verified.
  - 2. All analog input channels shall be verified for proper operation.
  - 3. All digital input channels shall be verified by changing the state of the field device and observing the appropriate change of displayed value.
  - 4. If a point should fail testing, perform necessary repair action and retest failed point and all interlocked points.
  - 5. Automatic control operation shall be verified by introducing an error into the system and observing the proper corrective system response.
  - 6. Selected time and setpoint schedules shall be verified by changing the schedule and observing the correct response on the controlled outputs.
- C. As-Built Documentation: After a successful acceptance demonstration, the Contractor shall submit as-built drawings of the completed project for final approval. After receiving final approval, supply "6" complete as-built drawing sets, together with AutoCAD or Visio diskettes to the owner.
- D. Operation and Maintenance Manuals: Submit four copies of operation and maintenance manuals. Include the following
  - 1. Manufacturer's catalog data and specifications on sensors, transmitters, controllers, control valves, damper actuators, gauges, indicators, terminals, and any miscellaneous components used in the system.
  - 2. An operator's manual that will include detailed instructions for all operations of the system.
  - 3. An operator's reference table listing the addresses of all connected input points and output points. Settings shall be shown where applicable.
  - 4. A copy of the warranty/guarantee.
  - 5. Operating and maintenance cautions and instructions.

### 3.4 TRAINING

- A. Contractor shall provide to the engineer a training class outline prior to any scheduled training.
- B. Factory trained control engineers and technicians shall provide training sessions for the Owner's personnel.
- C. The control contractor shall conduct six (6) four-hour training courses for the designated owners personnel in the maintenance and operation of the control system. One class

shall be given before system acceptance and the others monthly into the warranty/guarantee time period.

- D. The course shall include instruction on specific systems and instructions for operating the installed system to include as a minimum:
1. HVAC system overview
  2. Operation of Control System
  3. Function of each Component
  4. System Operating Procedures
  5. Programming Procedures
  6. Maintenance Procedures

### 3.5 WARRANTY/GUARANTEE

- A. The control system shall be warranted / guaranteed to be free from defects in both material and workmanship for a period of one (1) year of normal use and service. This warranty/guarantee shall become effective the date the owner accepts or receives beneficial use of the system.

END OF SECTION 239750



**SECTION 239950 - SYSTEM COMMISSIONING, TESTING AND BALANCING**

**PART 1 – GENERAL**

**1.1 GENERAL CONDITIONS:**

- A. Work of this section shall be subject to the requirements of the General Conditions of this contract, the General Mechanical Requirements, General Electrical Requirements and other sections where this work shares a responsibility.
- B. System commissioning and startup of the mechanical systems shall be the responsibility of the Mechanical Contractor and his subcontractors with the participation of the Electrical Contractor related to electrical work and the General Contractor related to general construction items.
- C. Testing and Balancing shall be the responsibility of the Mechanical Contractor under the direction of the General Contractor with the full participation of all of the mechanical and electrical trades employed on the project and shall include the participation of an independent testing and balance contractor to coordinate all elements of the work and to perform special technical services outlined herein.

**1.2 SYSTEM COMMISSIONING - EXTENT OF WORK:**

- A. The work required by this section includes but is not necessarily limited to the following:
  - 1. The pre-startup inspection of all systems and subsequent correction of any incorrect items.
  - 2. The initial first run inspections.
  - 3. System operations inspection.
- B. The intent of this work is to provide for proper installation, startup, service and operation of the mechanical systems in preparation for system balancing.
- C. Repair, replacement or adjustment of each item shall be performed by the installing contractor.
- D. Involves all new construction and those elements of existing construction which are affected by this project.

**1.3 TESTING AND BALANCING - EXTENT OF WORK:**

- A. This work incorporates a confirming checkout of construction work, individual component activation, and overall system activation into one work program which shall serve as the transition period from the Contractor's job to Owner's facility.
- B. The TAB Contractor shall be skilled in the operation and manipulation of systems and in the direction of parties involved in the work.
- C. Conduct and participate in the startup and shakedown of all mechanical systems installed and modified in this contract; test adjust and balance these systems to obtain optimum performance at a level which minimizes the required energy input, prepare and submit a complete report of work done and the final system condition obtained, participate in the

instruction of Owner's personnel in the proper operation of systems and equipment.

- D. Involves all new construction and those elements of existing construction which are affected by this project.

#### 1.4 QUALIFICATIONS OF SYSTEM COMMISSIONING AND TAB TEAM:

- A. Representatives of the General Contractor, Mechanical Contractor, etc., and Electrical Contractor shall be available on a daily basis through the commissioning and adjustment period. These men shall be experienced journeymen with prior experience in system operation and with specific experience on the construction of this project.
- B. Balancing shall be done by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with any engineering, contracting, or manufacturing firm and derives its income solely from testing, adjusting and balancing mechanical systems. Approved firms to do this work are R & S Balancing, Salt Lake City, Utah or Barnett, Inc., Payson, Utah, or BTC Services, Salt Lake City, Utah or Certified Testing and Balancing, Inc., Riverton, Utah.
- C. The balancing work including air and hydronic portions shall be performed by the same firm having total responsibility for the final testing, adjusting and balancing of the entire system. A principal of the firm shall be directly involved in the project.
- D. The independent testing and balancing firm shall furnish all necessary tools, scaffolding and ladders that are required and shall provide all required instruments, take all readings and make all necessary adjustments.
- E. After all tests and adjustments are made a detailed written report shall be prepared and submitted for review, and shall bear the signature of the professional supervising the work. Final acceptance of this project will not be made until a complete and satisfactory report is received. Furnish four copies of the report.

## PART 2 - EXECUTION, SYSTEM COMMISSIONING

### 2.1 PRE-STARTUP INSPECTION:

- A. The pre-startup inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.
- B. All pertinent items shall be checked, including but not necessarily limited to the following:
  - 1. Removal of shipping stops.
  - 2. Vibration isolators properly aligned and adjusted.
  - 3. Flexible connections properly aligned.
  - 4. Belts properly adjusted.
  - 5. Belt guards and safety shields in place.
  - 6. Safety controls, safety valves and high or low limits in operation.
  - 7. All systems properly filled.
  - 8. Filters in place and seal provided around edges.
  - 9. Fire dampers and smoke dampers properly installed and linked. Access doors provided for every damper.
  - 10. Pressure and temperature gauges installed.

11. All test stations and measuring devices installed.
12. Initial lubrication of equipment is complete.
13. Filters and strainers are clean.
14. Motor rotations are correct.
15. Voltages match nameplate.
16. Control system is in operation.
17. All interlocks are wired and verified.
18. All controls have been connected and verified.
19. All valves, dampers and operators are properly installed and operating.
20. All ductwork is installed and connected.
21. All other items necessary to provide for proper startup.

## 2.2 FIRST RUN INSPECTION:

- A. Recheck all items outlined in pre-startup inspection to insure proper operation.
- B. Check the following items:
  1. Excessive vibration or noise.
  2. Loose components.
  3. Initial control settings.
  4. Motor amperages.
  5. Heat buildup in motors, bearings, etc.
  6. Control system is properly calibrated and functioning as required.
- C. Correct all items which are not operating properly.

## 2.3 SYSTEM OPERATION INSPECTION:

- A. Observe mechanical systems under operating conditions for sufficient time to insure proper operation under varying conditions, such as day-night and heating-cooling.
- B. Periodically check the following items:
  1. Strainers and filters.
  2. Visual checks of air flow for "best guess" settings for preparation for system air balancing under section applying.
  3. Control operation, on-off sequences, system cycling, etc.
  4. Visual checks of water flow, seals, packings, safety valves, operation pressures and temperature.
  5. Dampers close tightly.
  6. Valves close tightly.
  7. System leaks.
  8. All other items pertaining to the proper operation of the mechanical system whether specifically listed or not.
  9. Proper combustion of fuels.
  10. Cleaning of excessive oil or grease.

## PART 3 - EXECUTION - TESTING AND BALANCING

### 3.1 TOTAL MECHANICAL SYSTEM BALANCE:

- A. The mechanical systems balance involves elements of the work of the General

Contractor, the Electrical Contractor, the Mechanical Contractor, the Sheet Metal Contractor and the Controls Contractor. Total system balance requires that all elements be not only individually correct, but also correct as a composite system. Therefore, participation of all parties shall be required in the test and balance procedure.

- B. Prior to beginning work, a written description of the anticipated sequence of action shall be submitted to the Architect/Owner for review and comment.
- C. The testing and balance specialist shall review the contract drawings during the bid period and shall advise the Architect of any modifications to the layout which may be needed to facilitate the balance procedure. Modifications will be incorporated into the contract by Addendum during the bidding period.
- D. The test and balance specialist shall visit the project from time to time during the rough installation making a thorough inspection of those items which will affect his subsequent work. He shall advise the Contractor in writing with a copy to the Architect of any work required by the contract which is not being performed adequately. This is in addition to the regular inspection efforts of the Architect and Engineer. Particularly note needed valves, dampers, access doors, thermometers, pressure gauges, belts and drives, diffuser styles, strainers and filters, etc.

### 3.2 AIR SYSTEMS BALANCE:

- A. Before any adjustments are made, check the systems for such items as dirty filters, duct leakage, filter leakage, damper leakage, equipment vibrations, correct damper operations, etc. Adjust all fan systems, major duct sections, registers, diffusers, etc., to deliver design air quantities within +5%. Individual air outlets, when one of three or more serve a space may have a tolerance of 10 percent from the average. Design static pressure is based on filters approximately 50% loaded with dirt. Pressure drop across filters during balancing shall be simulated to that condition. After balancing is completed check motor amperage with the filters clean.
- B. Adjust supply, and recirculation air systems towards air quantities shown on drawings. Establish a proper relationship between supply and exhaust. Follow proportional balance procedures outlined by AABC and/or SMACNA for such work.
- C. Distribution system shall be further adjusted to obtain uniform space temperatures free from objectionable drafts and noise within the capabilities of the system.

### 3.3 HYDRONIC SYSTEMS:

- A. Before any adjustments are made, clean strainers, check temperature control valve operation, check pump rotation, adjust pressure reducing valves, etc.
- B. Using system flow meters, pressure gauges, and/or contact pyrometer, adjust the quantity of fluid handled by each pump and supplied to each coil, piece of radiation, heat exchanger, etc., to meet design requirements. Use proportional balance techniques to minimize system pressure requirements.
  - 1. Remove and trim pump impellers where throttling exceeds 10% of adequate flow.

- 3.4 MAJOR EQUIPMENT: The Testing and Balancing Contractor shall work with the Controls Contractor and Electrician in placing chiller, boilers, pumps, fans and other major equipment in operation. The factory representative of the equipment manufacturer shall also participate in a team effort to place the system(s) in operation, adapt to all anticipated operating modes and

make adjustments as required to obtain correct operation. The Design Engineer and the Owner's Representative shall witness the final operating sequences.

- A. Use proportional balance techniques so that in every case, at least one terminal valve is set for full flow at wide open, and at least one branch valve is wide open at full flow, others equivalent.

3.5 CONTROL SYSTEMS: The Testing and Balancing Contractor shall go through the entire control system with the Controls Contractor verifying proper operation of each and every device and the proper function of each system. Certify such effort in the report.

3.6 MISCELLANEOUS:

- A. Observe and note all furnished thermal overload protection in the data sheets. If thermal overload protection is incorrect, the trade which furnished the overload devices shall furnish and install the correct size overload protection devices. It shall be the responsibility of the balancing firm to confirm that proper overload protection has been installed at the completion of the job.
- B. Measure and set any special conditions such as minimum air quantities; coordinate outside air, return air and relief air damper operation; check and adjust outside and return air intakes so that the system will deliver substantially the same volume on either; make tests and record data as required in "REPORT" below.
- C. All balancing devices, i.e. dampers and valves, shall be clearly marked as to the final balanced position. Plug all test holes, replace access doors and belt guards.
- D. Upon request, based on perceived need, make 24-hour space temperature recordings. Any required rebalance of the system shall be performed without additional cost.
- E. Upon request, a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by reading back outlets or terminals selected specifically or at random by the Design Engineer. It is understood that the operating mode of the system shall be the same for read-back as it was during balancing.

3.7 REPORT:

- A. Provide a bound report in four copies containing a general information sheet listing instruments used, method of balancing, altitude correction, and manufacturer's grille, register and diffuser data.
- B. Provide equipment data sheets listing make, size, serial number, rating, etc. of all mechanical equipment including fans, air controllers, pumps, motors, starters and drives. Operating data shall include rotational speed, inlet and outlet pressures, pressure drop across filters, coils, and other system components, pump heads, and measured motor current and voltage.
- C. Balancing data sheets shall indicate the required and actual CFM of all supply, return and exhaust outlets or inlets, and be totaled and summarized by systems.
- D. Hydronic balancing data sheets shall list required temperature or pressure differentials used for balancing coils, radiations, condensers, etc. Sheets shall show in comparison final as-balanced versus design values.
- E. Include a reduced set of contract drawings with outlets marked for easy identification of

the signation used in the data sheets.

- F. Note any abnormal or notable conditions not covered in the above.
- G. Keep a daily log of all work performed, with a list of work scheduled for each day and the workers on the job.

END OF SECTION 239950

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  
260548 VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS  
260553 IDENTIFICATION FOR ELECTRICAL SYSTEMS  
260923 LIGHTING CONTROL DEVICES  
260943 RELAY BASED LIGHTING CONTROLS  
262416 PANELBOARDS  
262726 WIRING DEVICES  
262816 ENCLOSED SWITCHES AND CIRCUIT BREAKERS  
262913 ENCLOSED CONTROLLERS  
265100 INTERIOR LIGHTING

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## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### 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 wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 271500 "Communications Horizontal Cabling" for cabling used for voice and data circuits.

#### 1.3 QUALITY ASSURANCE

### 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 THHN-2-THWN-2 Type and XHHW-2.
- C. Multiconductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for metal-clad cable, Type MC and Type SOW 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.



### 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 or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid or stranded 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-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- B. Feeders: Type THHN-2-THWN-2, single conductors in raceway or Type XHHW-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway or Metal-clad cable, Type MC.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SOW, 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."

- G. Complete cable tray systems installation according to Section 260536 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

### 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 and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 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."

END OF SECTION 260519

## SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

#### 1.3 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 UL 467 for grounding and bonding materials and equipment.

### 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 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 Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 5. 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.
  - 6. 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 exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

## 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. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- 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 SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

## 3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. 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.
- C. 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.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- 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 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 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 three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. 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.
- D. 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.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.
- G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.
1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
  2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
- B. Related Sections include the following:
  - 1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. 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.

#### 1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

#### 1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

## 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. 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 hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. 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, stainless steel or Aluminum, 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 or Aluminum.

## 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 or single-bolt conduit clamps using spring friction action for retention in support channel.
- 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 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 or Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- 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.

**END OF SECTION 260529**

## SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.
5. Handholes and boxes for exterior underground cabling.

- B. Related Requirements:

1. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.
2. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving electronic safety and security.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

### 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. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- 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.
    - 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. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- 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).

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1, Type 3R, Type 4, or Type 12 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.
- C. Wireway Covers: Flanged-and-gasketed type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

#### 2.4 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. Metal Floor Boxes:
  1. Material: 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.
- E. 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.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- H. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- I. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as required for installed location with continuous-hinge cover with flush latch unless otherwise indicated.
  1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:

1. NEMA 250, Type as required for installed location galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.5 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.
7. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.6 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

### A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Aboveground: GRC.
  - 2. Underground Conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC,.
  - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 4. 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 Physical Damage: EMT.
  - 3. Exposed and Subject to Physical Damage: GRC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
    - d. Garages
  - 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.
  - 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
  
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
  
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid 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, steel 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. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
  
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
  
- G. Install surface raceways only where indicated on Drawings.
  
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

- 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. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. 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.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. 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 RNC to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. 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.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.



- N. 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 (35mm) 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.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. 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.
- S. 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.
- T. 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. Install raceway sealing fittings according to NFPA 70.
- U. 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.
- V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- W. 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). Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 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.
- 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
  - 4. Install expansion fittings at 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.
- X. 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 in damp or wet locations.
  - Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
  - Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
  - BB. Locate boxes so that cover or plate will not span different building finishes.
  - CC. 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.
  - DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - EE. Set metal floor boxes level and 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 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.
5. 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 removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.
- E. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 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."

- 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 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. 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.

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. 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. Advance Products & Systems, Inc.
    - b. CALPICO, Inc.
    - c. Metraflex Company (The).
    - d. Pipeline Seal and Insulator, Inc.
    - e. Proco Products, Inc.
  2. 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.
  3. Pressure Plates: Carbon steel or Stainless steel.
  4. Connecting Bolts and Nuts: Stainless steel 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.
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. Presealed Systems.

## 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.
    - 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 or unless seismic criteria require different clearance.
  4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between 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 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Isolation pads.
  - 2. Channel support systems.
  - 3. Restraint cables.
  - 4. Hanger rod stiffeners.
  - 5. Anchorage bushings and washers.
- B. Related Sections include the following:
  - 1. Division 26 Section "Hangers And Supports For Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
  - 1. Site Class as Defined in the IBC: D.
  - 2. Site Class as Defined in the IBC: D.
  - 3. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
    - a. Component Importance Factor:
      - 1) General: 1.0.
      - 2) Life Safety (EM): 1.5
    - b. Component Response Modification Factor:
      - 1) Fixtures: 1.5
      - 2) Equipment: 2.5

- 3) Conduit and Cables: 5.0.
  - c. Component Amplification Factor: 2.5.
4. Design Spectral Response Acceleration at Short Periods (0.2 Second): 173%.
5. Design Spectral Response Acceleration at 1.0-Second Period: 76%.

#### 1.5 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

#### 1.6 SUBMITTALS

- A. Product Data: For each type of product.
  1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
  1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
  3. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods,

and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

- c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Welding certificates.

D. Field quality-control reports.

## PART 2 - PRODUCTS

### 2.1 VIBRATION ISOLATORS

A. 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:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene or rubber.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

## 2.2 SEISMIC-RESTRAINT DEVICES

- A. 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:
1. Amber/Booth Company, Inc.
  2. California Dynamics Corporation.
  3. Cooper B-Line, Inc.; a division of Cooper Industries.
  4. Hilti Inc.
  5. Loos & Co.; Seismic Earthquake Division.
  6. Mason Industries.
  7. TOLCO Incorporated; a brand of NIBCO INC.
  8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized or ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
  - 1. Powder coating on springs and housings.
  - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
  - 3. Baked enamel or powder coat for metal components on isolators for interior use.
  - 4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

#### 3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
  - 1. Install restrained isolators on electrical equipment.
  - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
  - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
  
- D. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
  - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### 3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  
- B. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  - 5. Test to 90 percent of rated proof load of device.
  - 6. Measure isolator restraint clearance.
  - 7. Measure isolator deflection.
  - 8. Verify snubber minimum clearances.
  - 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
  
- C. Remove and replace malfunctioning units and retest as specified above.

- D. Prepare test and inspection reports.

### 3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust active height of spring isolators.
- C. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 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.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

#### 1.4 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.

#### 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's



wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Write-on, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

### 2.2 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

### 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
  - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications 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,.

## 2.4 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. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."
  - 2. Arc Flash Hazard Warning: Manufacturer's standard.

## 2.5 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.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. 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).
- B. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

## 2.7 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 12,000 psi (82.7 MPa).
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black.

- C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength at 73 deg F ((23 deg C)), According to ASTM D 638: 7000 psi (48.2 MPa).
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
  - 5. Color: Black.

## 2.8 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. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
  - 1. Outdoors: UV-stabilized nylon.
  - 2. In Spaces Handling Environmental Air: Plenum rated.

- J. 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.
- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

### 3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
  - 1. Emergency Power.
  - 2. Power.
  - 3. UPS.
- B. 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 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.
      - 4) Neutral: White with colored stripe to match associated phase
      - 5) Ground: Green
      - 6) Isolated Ground: Green with continuous yellow stripe
    - c.
    - d. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown
      - 2) Phase B: Yellow
      - 3) Phase C: Violet
      - 4) Neutral: White with colored stripe to match associated phase
      - 5) Ground: Green with gray stripe
    - e. 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.
- C. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- D. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive vinyl labels with the conductor designation.

- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- F. 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.
- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
  - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- H. 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.
- I. 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.
- J. 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.
- K. 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: Self-adhesive, engraved, laminated acrylic or melamine 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.

2. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be self-adhesive, engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Enclosed switches.
  - e. Enclosed circuit breakers.
  - f. Enclosed controllers.
  - g. Push-button stations.
  - h. Contactors.
  - i. Remote-controlled switches, dimmer modules, and control devices.
  - j. UPS equipment.

END OF SECTION 260553

## SECTION 260923 - LIGHTING CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Photoelectric switches.
  - 2. Indoor occupancy sensors.
- B. Related Requirements:
  - 1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Interconnection diagrams showing field-installed wiring.
  - 2. Include diagrams for power, signal, and control wiring.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufactureres: Subject to compliance with requirements, provide products by one of the following

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

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, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

## 2.2 DAYLIGHT-HARVESTING SWITCHING CONTROLS

A. Manufactureres: Subject to compliance with requirements, provide products by one of the following

1. Cooper Industries, Inc.
2. Intermatic, Inc.
3. NSi Industries LLC; TORK Products.
4. Tyco Electronics; ALR Brand.

B. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.

C. Electrical Components, Devices, and Accessories:

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. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by 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. General Space Sensors Light-Level Monitoring Range: 10 to 200 fc (108 to 2152 lux), with an adjustment for turn-on and turn-off levels within that range.
6. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
7. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
8. Test Mode: User selectable, overriding programmed time delay to allow settings check.
9. Control Load Status: User selectable to confirm that load wiring is correct.
10. Indicator: Two digital displays to indicate the beginning of on-off cycles.



## 2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Industries, Inc.
  2. Hubbell Building Automation, Inc.
  3. Leviton Mfg. Company Inc.
  4. Lightolier Controls.
  5. Lithonia Lighting; Acuity Lighting Group, Inc.
  6. Lutron Electronics Co., Inc.
  7. Sensor Switch, Inc.
  8. Square D; a brand of Schneider Electric.
  9. Watt Stopper.
- B. 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.
- C. 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.
- D. 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).

E. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.
2. Hubbell Building Automation, Inc.
3. Leviton Mfg. Company Inc.
4. Lightolier Controls.
5. Lithonia Lighting; Acuity Lighting Group, Inc.
6. Lutron Electronics Co., Inc.
7. Sensor Switch, Inc.
8. Square D; a brand of Schneider Electric.
9. Watt Stopper.

B. 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.

## 2.5 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. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

## 3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. 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.

## 3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

## 3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 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.
- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 ADJUSTING

- A. 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 two 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.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.

3.6 DEMONSTRATION

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

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. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Include evidence of NRTL listing for series rating of installed devices.
  - 7. Include evidence of NRTL listing for SPD as installed in panelboard.

8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock.

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

#### 1.10 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).

- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than two weeks in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Owner's written permission.
  - 3. Comply with NFPA 70E.

#### 1.11 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 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Company

#### 2.2 PANELBOARDS AND LOAD CENTERS 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. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. 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.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: 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. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - e. 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.
  5. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  6. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  7. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel.
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:
1. Location: Convertible between top and bottom.
- H. Phase, Neutral, and Ground Buses:
1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
  5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Tin-plated aluminum or Hard-drawn copper, 98 percent conductivity.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
  6. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- J. NRTL Label: Panelboards or load centers 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 or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- 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.
1. Panelboards rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.



2. Panelboards rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.3 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."

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- C. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with series-connected rating 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. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  4. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  5. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    - f. Shunt Trip: 24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
    - g. Multipole units enclosed in a single housing with a single handle or factory assembled to operate as a single unit.
    - h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
    - i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 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 metal frame with transparent protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
  - 2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- F. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

- I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- J. Install filler plates in unused spaces.
- K. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- L. Mount spare fuse cabinet in accessible location.

### 3.3 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. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.4 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. 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.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

## SECTION 260943 - RELAY-BASED LIGHTING CONTROLS

### 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: Networked lighting control panels using control-voltage relays for switching.

#### 1.3 DEFINITIONS

- A. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- B. PC: Personal computer; sometimes plural as "PCs."
- C. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each relay panel and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail wiring partition configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of relays.
  - 5. Include diagrams for power, signal, and control wiring.
  - 6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
  - 1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.
  - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.
- B. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lighting Control Relays: Equal to ten percent of amount installed for each size indicated, but no fewer than three.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panels for installation according to NECA 407.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
- 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 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with UL 916.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Lighting control panels 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 when subjected to the seismic forces specified."
  - 2. Component Importance Factor: 1.5.

## 2.3 NETWORKED LIGHTING CONTROL PANELS

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Cooper Greengate
  - 2. Crestron
  - 3. Douglass
  - 4. Leviton Mfg. Company Inc.
  - 5. Lighting Control & Design, Inc.
  - 6. Lightolier Controls; a Genlyte Company.
  - 7. Lutron Electronics Company, Inc.
  - 8. NexLight; Northport Engineering Group.
  - 9. Watt Stopper (The).
- B. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.
- C. Lighting Control Panels:
  - 1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
  - 2. A vertical barrier separating branch circuits from control wiring.
- D. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.
  - 1. Ethernet Communications: Comply with MS Windows TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
  - 2. Compliance with ASHRAE 135: Controllers shall support serial MS/TP and Ethernet IP communications, and shall be able to communicate directly via BAS RS-485 serial networks and Ethernet 10Base-T networks as a native device.
  - 3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.
    - a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
    - b. Panel summary showing the master and slave panels connected to the controller.
    - c. Controller diagnostic information.

- d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.
4. Timing Unit:
    - a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
    - b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
    - c. Four independent schedules, each having 24 time periods.
    - d. Schedule periods settable to the minute.
    - e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
    - f. 16 special date periods.
  5. Time Synchronization: The timing unit shall be updated not less than every hour(s) with the network time server.
  6. Sequencing Control with Override:
    - a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
    - b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
    - c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
    - d. Override control "blinking warning" shall warn occupants approximately five minutes before actuating the off sequence.
    - e. Activity log, storing previous relay operation, including the time and cause of the change of status.
    - f. Download firmware to the latest version offered by manufacturer.
- E. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.
1. Electronic control for operating and monitoring individual relays, and display relay on-time.
  2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
- F. Operator Interface:
1. Integral touchscreen keypad and digital display, and intuitive menus to assist in programming.
  2. Log and display relay on-time.
  3. Connect relays to one or more time and sequencing schemes.
  4. Blink notice, time adjustable from software.
  5. Ability to log and display relay on-time.
  6. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.
- G. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be digital control network.



- H. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
- I. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.
- J. Software:
  - 1. Menu-driven data entry.
  - 2. Online and offline programming and editing.
  - 3. Provide for entry of the room or space designation for the load side of each relay.
  - 4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
  - 5. Size the software appropriate to the system.

## 2.4 MANUAL SWITCHES AND PLATES

- A. Push-Button Switches: Modular, digital type communicating with control panel over digital bus.
  - 1. Match color specified in Division 26 Section "Wiring Devices."
  - 2. Integral green LED pilot light to indicate when circuit is on.
  - 3. Internal white LED locator light to illuminate when circuit is off.
  - 4. Manufacturers: Compatible with control systems specified. Examples of acceptable switches include, but are not limited to:
    - a. Cooper Greengate: Digita series
    - b. Leviton: Z-MAX series
    - c. LC&D: Chelsea DigitalSwitch
  - 5. Integral green LED pilot light to indicate when circuit is on.
  - 6. Internal white LED locator light to illuminate when circuit is off.
- B. Wall Plates: Single and multigang plates as specified in Section 262726 "Wiring Devices."
- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

## 2.5 FIELD-MOUNTED SIGNAL SOURCES

- A. Daylight Harvesting Switching Controls: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.
- B. Indoor Occupancy Sensors: Comply with Section 260923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

## 2.6 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 22 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 16 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 271500 "Communications Horizontal Cabling."

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
  - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
  - 2. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
  - 3. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- D. Mount panel cabinet plumb and rigid without distortion of box.
- E. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 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.
- C. Acceptance Testing Preparation:
  - 1. Test continuity of each circuit.
- D. Lighting control panel will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.
  - 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 260943

## SECTION 262726 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. Weather-resistant receptacles.
  - 4. Snap switches and wall-box dimmers.
  - 5. Pendant cord-connector devices.
  - 6. Cord and plug sets.
  - 7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.

#### 1.5 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.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. 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.
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

## 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:

### C. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:

## 2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

### A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

## 2.6 TWIST-LOCKING RECEPTACLES

### A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

## 2.7 PENDANT CORD-CONNECTOR DEVICES

### A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.8 CORD AND PLUG SETS

### A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Single Pole:
      - 1) Cooper; AH1221.
      - 2) Hubbell; HBL1221.
      - 3) Leviton; 1221-2.
      - 4) Pass & Seymour; CSB20AC1.
    - b. Two Pole:
      - 1) Cooper; AH1222.
      - 2) Hubbell; HBL1222.
      - 3) Leviton; 1222-2.
      - 4) Pass & Seymour; CSB20AC2.
    - c. Three Way:
      - 1) Cooper; AH1223.
      - 2) Hubbell; HBL1223.
      - 3) Leviton; 1223-2.
      - 4) Pass & Seymour; CSB20AC3.
    - d. Four Way:
      - 1) Cooper; AH1224.
      - 2) Hubbell; HBL1224.
      - 3) Leviton; 1224-2.
      - 4) Pass & Seymour; CSB20AC4.
- C. Pilot-Light Switches, 20 A:
  - 1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

2.10 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.



- D. LED Lamp Dimmer Switches: Modular; compatible with dimming drivers; trim potentiometer to adjust low-end dimming; dimmer-driver combination capable of consistent dimming with low end not greater than 5 percent of full brightness.

## 2.11 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: Galvanized steel.
  - 4. Material for Damp Locations: Cast aluminum 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 or thermoplastic with lockable cover.

## 2.12 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, with satin finish.
- D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in Section 271500 "Communications Horizontal Cabling."

## 2.13 FINISHES

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: White or As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Isolated-Ground Receptacles: Orange.
- 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 left.

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 floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

A. Install feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Label all device cover plates with panel and circuit number using permanently installed, type-written, stick-on labels or engraving

1. Devices connected to normal source power: Black text
2. Devices connected to backup source power: Red text

### 3.4 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 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

### 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. Nonfusible switches.
  - 2. Molded-case circuit breakers (MCCBs).
  - 3. Enclosures.

#### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### 1.4 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."

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

- 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.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, 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. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

#### 1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NFPA 70.

## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  2. Altitude: Not exceeding 6600 feet (2010 m).

## 1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Sector; Eaton Corporation.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.

## 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. 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. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  4. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  6. Lugs: Mechanical type, suitable for number, size, and conductor material.

## 2.3 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. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- D. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- E. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

## 2.4 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. Wash-Down Areas: NEMA 250, Type 4X.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  - 6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 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. Comply with NECA 1.

### 3.3 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.

### 3.4 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION 262816



## SECTION 262913 - ENCLOSED CONTROLLERS

### 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 the following enclosed controllers rated 600 V and less:
  - 1. Full-voltage manual.
  - 2. Full-voltage magnetic.

#### 1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed controllers 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."

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:
  - a. Each installed unit's type and details.
  - b. Factory-installed devices.
  - c. Nameplate legends.
  - d. Short-circuit current rating of integrated unit.
  - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
  - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
2. Wiring Diagrams: For power, signal, and control wiring.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For enclosed controllers, 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.
- C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Routine maintenance requirements for enclosed controllers and installed components.
  2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  3. Manufacturer's written instructions for setting field-adjustable overload relays.
  4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

#### 1.8 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.

- C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

#### 1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
  - 2. Altitude: Not exceeding 6600 feet (2010 m).

#### 1.11 COORDINATION

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton Electrical Sector; Eaton Corporation.
  - 2. General Electric Company.
  - 3. Siemens Industry, Inc.
  - 4. Square D; by Schneider Electric.

#### 2.2 FULL-VOLTAGE CONTROLLERS

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.

1. Configuration: Nonreversing.
  2. Flush or Surface mounting.
  3. Green pilot light.
- C. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Configuration: Nonreversing.
  2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type or melting alloy type.
  3. Flush or Surface mounting.
  4. Green pilot light.
- D. Magnetic Controllers: Full voltage, across the line, electrically held.
1. Configuration: Nonreversing.
  2. Contactor Coils: Pressure-encapsulated type.
    - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
  3. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
  4. Control Circuits: As required.
  5. Solid-State Overload Relay:
    - a. Switch or dial selectable for motor running overload protection.
    - b. Sensors in each phase.
    - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    - d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
    - e. Analog communication module.
  6. N.C./N.O., isolated overload alarm contact.
  7. External overload reset push button.
- E. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
1. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
  2. Nonfusible Disconnecting Means:
    - a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
    - b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
    - c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
  3. MCP Disconnecting Means:
    - a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

- b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
  - c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
  - d. N.C./N.O. alarm contact that operates only when MCP has tripped.
  - e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
4. MCCB Disconnecting Means:
- a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
  - b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
  - d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
  - e. N.C./N.O. alarm contact that operates only when MCCB has tripped.

### 2.3 ENCLOSURES

- A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
- 1. Dry and Clean Indoor Locations: Type 1.
  - 2. Outdoor Locations: Type 3R.
  - 3. Wash-Down Areas: Type 4X.
  - 4. Other Wet or Damp Indoor Locations: Type 4.
  - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
  - 6. Hazardous Areas Indicated on Drawings: Type 7.

### 2.4 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
- 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
    - a. Push Buttons: Shrouded types; momentary as indicated.
    - b. Pilot Lights: LED types; colors as indicated; push to test.
    - c. Selector Switches: Rotary type.
  - 2. Meters: Panel type, 2-1/2-inch (64-mm) minimum size with 90- or 120-degree scale and plus or minus two percent accuracy. Where indicated, provide selector switches with an off position.
- B. Reversible N.C./N.O. auxiliary contact(s).
- C. Breather and drain assemblies, to maintain interior pressure and release condensation in Type 4 Type 4X, and/or Type 7 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

- D. Cover gaskets for Type 1 enclosures.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
  - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
  - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Seismic Bracing: Comply with requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.
- F. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- G. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified 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 nameplate.
  - 3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

- A. Install wiring between enclosed controllers and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
  - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

END OF SECTION 262913

## SECTION 265100 - INTERIOR LIGHTING

### 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 lighting fixtures, lamps, and ballasts.
- 2. Exit signs.
- 3. Lighting fixture supports.

- B. Related Sections:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
- 2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

#### 1.3 DEFINITIONS

- A. BF: Ballast factor.
- B. CCT: Correlated color temperature.
- C. CRI: Color-rendering index.
- D. HID: High-intensity discharge.
- E. LER: Luminaire efficacy rating.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting fixture, including ballast housing if provided.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of lighting fixture including dimensions.
  - 2. Emergency lighting units including battery and charger.
  - 3. Ballast, including BF.
  - 4. Energy-efficiency data.
  - 5. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.



- B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
    - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    - 2. Wiring Diagrams: For power, signal, and control wiring.
  - C. Installation instructions.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.
  - B. Field quality-control reports.
  - C. Warranty: Sample of special warranty.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
    - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.
- 1.7 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
    - 2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
    - 3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
    - 4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.
- 1.8 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.
  - C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- 1.9 COORDINATION
- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide product indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.
- B. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
- C. LED Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE5 and NEMA LE5A as applicable
- D. Metal Parts: Free of burrs and sharp corners and edges.
- E. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- 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.
- G. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
    - b. UV stabilized.
  2. Glass: Annealed crystal glass unless otherwise indicated.
- H. 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. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and 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, etc.) for fluorescent and compact fluorescent luminaires.
    - e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
    - f. CCT and CRI for all luminaires.

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  - 1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
  - 2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    - f. 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.

## 2.4 LED LUMINAIRES

- A. Solid State Drivers and LED: Comply with DOE LM 79
  - 1. Total Harmonic Distortion Rating: Less than 10 percent
  - 2. Transient Voltage protection
  - 3. Power factor: 0.90 or higher
  - 4. Temperatures: Minus 40 deg F (minus 40 deg C) and higher
  - 5. Heat sink to remove heat from circuits
  - 6. L70 compliant to 70,000 hours minimum
  - 7. Color Rendering Index: 80 CRI minimum
  - 8. Dimmable
    - a. Dimming Range: 100 to 1 percent of rated lamp lumens
    - b. Input watts: Can be reduced to 20 percent of normal
    - c. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.

## 2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- C. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless 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 fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Lighting fixtures:
  - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
  - 2. Install lamps in each luminaire.
- B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.
- C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
  - 2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
  - 3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.
- E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

#### 3.2 IDENTIFICATION

- A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

#### 3.3 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to backup and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
  - 1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

270528 PATHWAYS FOR COMMUNICATIONS SYSTEMS  
270536 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

COMMUNICATIONS

division **27**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

## SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Metal conduits and fittings.
- 2. Boxes, enclosures, and cabinets.

- B. Related Requirements:

- 1. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
- 2. Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling" for sealing of penetrations of communications pathways through building elements.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS AND FITTINGS

- A. General Requirements for Metal Conduits and Fittings:

- 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 2. Comply with TIA-569-B.

- B. GRC: Comply with ANSI C80.1 and UL 6.

- C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

- 1. Comply with NEMA RN 1.
- 2. Coating Thickness: 0.040 inch (1 mm), minimum.

- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Fittings for EMT:
    - a. Material: Steel or die cast.
    - b. Type: Setscrew or compression.
  - 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. General Requirements for Nonmetallic Conduits and Fittings:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569-B.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Rigid HDPE: Comply with UL 651A.
- D. Continuous HDPE: Comply with UL 651B.
- E. RTRC: Comply with UL 1684A and NEMA TC 14.
- F. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

## 2.3 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets:
  - 1. Comply with TIA-569-B.
  - 2. 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 or aluminum, Type FD, with gasketed cover.
- D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- 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. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.
- H. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- I. Gangable boxes are prohibited.

### PART 3 - EXECUTION

#### 3.1 PATHWAY APPLICATION

- A. Outdoors: Apply pathway products as specified below unless otherwise indicated:
  1. Aboveground Conduit: GRC.
  2. Underground Conduit: RNC, Type EPC-40-PVC,.
  3. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
  1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
    - d. Vehicle Garages
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Damp or Wet Locations: GRC.
  5. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway.
  6. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: EMT.
  7. Boxes and Enclosures: NEMA 250 Type 1, except use NEMA 250 Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
  1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. 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, steel cast-metal fittings. Comply with NEMA FB 2.10.

### 3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical-fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:
  1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
  2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
  3. Arrange pathways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
  4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
  1. Use EMT, IMC, or RMC for pathways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

- L. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
  - 1. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
  - 2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where an underground service pathway enters a building or structure.
  - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.
- V. 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.
- W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

- X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Y. 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.
- Z. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- AA. Set metal floor boxes level and flush with finished floor surface.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

### 3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage or 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 270528

## SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Ladder cable trays.
- 2. Wire-basket cable trays.

- B. Related Requirements:

- 1. Section 260536 "Cable Trays for Electrical Systems" for cable trays and accessories serving electrical systems.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cable tray.

- 1. Include data indicating dimensions and finishes for each type of cable tray indicated.

- B. Shop Drawings: For each type of cable tray.

- 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For cable trays, 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.

## 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
  2. Component Importance Factor: 1.5.

## 2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.
- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:
1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
  2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
  3. Load and Safety Factors: Applicable to both side rails and rung capacities.

## 2.3 LADDER CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Tube & Conduit; a Tyco International Ltd. Co.
  2. Chalfant Manufacturing Company.
  3. Cooper B-Line, Inc.
  4. Mono-Systems, Inc.
  5. MP Husky.
  6. Niedax-Kleinhuis USA, Inc.
- B. Description:
1. Configuration: Two I-beam side rails with transverse rungs welded to side rails.
  2. Rung Spacing: 9 inches (225 mm) o.c.
  3. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
  4. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
  5. No portion of the rungs shall protrude below the bottom plane of side rails.
  6. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.

7. Minimum Usable Load Depth: 6 inches (150 mm).
8. Width: 12 inches (300 mm) unless otherwise indicated on Drawings.
9. Fitting Minimum Radius: 12 inches (300 mm).
10. Class Designation: Comply with NEMA VE 1, Class 12C.
11. Splicing Assemblies: Bolted type using serrated flange locknuts.
12. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.
13. Splice Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

## 2.4 WIRE-BASKET CABLE TRAYS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cablofil/Legrande.
  2. Cooper B-Line, Inc.
- B. Description:
1. Configuration: Wires are formed into a standard 2-by-4-inch (50-by-100-mm) wire mesh pattern with intersecting wires welded together. Mesh sections must have at least one bottom longitudinal wire along entire length of section.
  2. Materials: High-strength-steel longitudinal wires with no bends.
  3. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
  4. Sizes:
    - a. Straight sections shall be furnished in standard 118-inch (3000-mm) lengths.
    - b. Wire-Basket Depth: 4-inch (100-mm) usable loading depth by 6 inches (150 mm) wide.
  5. Connector Assemblies: Bolt welded to plate shaped to fit around adjoining tray wires and mating plate. Mechanically joins adjacent tray wires to splice sections together or to create horizontal fittings.
  6. Connector Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
  7. Hardware and Fasteners: ASTM F 593 and ASTM F 594 stainless steel, Type 316.

## 2.5 MATERIALS AND FINISHES

- A. Steel:
1. Straight Section and Fitting Side Rails and Rungs: Steel complies with the minimum mechanical properties of ASTM A 1011/A 1011M, SS, Grade 33.
  2. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
  3. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
  4. Finish: Hot-dip galvanized after fabrication.
    - a. Standard: Comply with ASTM A 123/A 123M, Class B2.
    - b. Hardware: Chromium-zinc plated, ASTM F 1136.
- B. Aluminum:

1. Materials: Alloy 6063-T6 according to ANSI H 35.1/H 35.1M for extruded components and Alloy 5052-H32 or Alloy 6061-T6 according to ANSI H 35.1/H 35.1M for fabricated parts.
2. Hardware: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.
3. Hardware for Aluminum Cable Tray Used Outdoors: Stainless steel, Type 316, ASTM F 593 and ASTM F 594.

## 2.6 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.7 WARNING SIGNS

- A. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."
- B. Comply with requirements for fasteners in Section 260553 "Identification for Electrical Systems."

## 2.8 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

## PART 3 - EXECUTION

### 3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548 "Vibration and Seismic Controls for Electrical Systems."



- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support bus assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Support wire-basket cable trays with trapeze hangers or wall brackets.
- N. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- O. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- P. Make changes in direction and elevation using manufacturer's recommended fittings.
- Q. Make cable tray connections using manufacturer's recommended fittings.
- R. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- S. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- T. Install cable trays with enough workspace to permit access for installing cables.
- U. Install warning signs in visible locations on or near cable trays after cable tray installation.

### 3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.

- D. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

### 3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).
- C. In existing construction, remove inactive or dead cables from cable trays.

### 3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 2. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
  - 3. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
  - 4. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
  - 6. Check for improperly sized or installed bonding jumpers.
  - 7. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
  - 8. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.
- B. Prepare test and inspection reports.

### 3.6 PROTECTION

- A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 270536

280528 PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY  
283111 DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

ELECTRONIC SAFETY AND SECURITY

division **28**

**SAA**  
SANDERS ASSOCIATES ARCHITECTS

## SECTION 280528-PATHWAYS FOR ELECTRONIC SAFETY AND SECURITY

### 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. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Surface pathways.
6. Boxes, enclosures, and cabinets.
7. Handholes and boxes for exterior underground cabling.

- B. Related Requirements:

1. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wireways, surface raceways, boxes, enclosures, cabinets, handholes, and faceplate adapters serving electrical systems.
2. Section 270528 "Pathways for Communications Systems" for conduits, surface pathways, innerduct, boxes, and faceplate adapters serving communications systems.

#### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

### PART 2 - PRODUCTS

#### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

#### 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

## 2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Description: Comply with UL 2024; flexible-type pathway, approved for plenum, riser or general-use installation unless otherwise indicated.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with TIA-569-B.

## 2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections". Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R 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.
  - 2. Comply with TIA-569-B.
- B. Fittings and Accessories: Include 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.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

## 2.6 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

## PART 3 - EXECUTION

### 3.1 PATHWAY APPLICATION

- A. Outdoors: Refer to division 26 section "Raceways and Boxes for Electrical Sections".
- B. Indoors: Apply pathway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed and Subject to Physical Damage: GRC. Pathway locations include the following:
    - a. Mechanical rooms.
    - b. Gymnasiums

3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: GRC.
  6. Pathways for Optical-Fiber or Communications Cable: EMT.
  7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size: 3/4-inch (21-mm) trade size. Minimum size for optical-fiber cables is 1 inch (27 mm).
- D. Pathway Fittings: Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. 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, steel cast-metal 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 pathways 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. Refer to division 26 section "Raceways and Boxes for Electrical Sections" except as modified in this article.
- B. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- C. Stub-ups to Above Recessed Ceilings:
1. Use EMT, or RMC for pathways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- D. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:
1. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15 m).

2. 1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23 m).
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Refer to division 26 section "Raceways and Boxes for Electrical Sections".

### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY 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 280528**



SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Manual fire-alarm boxes.
  - 2. System smoke detectors.
  - 3. Air-sampling smoke detectors.
  - 4. Nonsystem smoke detectors.
  - 5. Heat detectors.
  - 6. Notification appliances.
  - 7. Addressable interface device.
- B. Related Requirements:
  - 1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.

1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  2. Include plans, elevations, sections, details, and attachments to other work.
  3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  4. Detail assembly and support requirements.
  5. Include voltage drop calculations for notification-appliance circuits.
  6. Include battery-size calculations.
  7. Include input/output matrix.
  8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
  9. Include performance parameters and installation details for each detector.
  10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
  12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    - b. Show field wiring required for HVAC unit shutdown on alarm.
    - c. Locate detectors according to manufacturer's written recommendations.
    - d. Show air-sampling detector pipe routing.
  13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
  2. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire-alarm system design.
    - b. NICET-certified, fire-alarm technician; Level III minimum.
    - c. Licensed or certified by authorities having jurisdiction.
- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
  2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
  3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, 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.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
    - d. Riser diagram.
    - e. Device addresses.
    - f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
    - g. Record copy of site-specific software.
    - h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      - 1) Equipment tested.
      - 2) Frequency of testing of installed components.
      - 3) Frequency of inspection of installed components.
      - 4) Requirements and recommendations related to results of maintenance.
      - 5) Manufacturer's user training manuals.
    - i. Manufacturer's required maintenance related to system warranty requirements.
    - j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.
4. Printout of software application and graphic screens.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL (nationally recognized testing laboratory).
- D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

#### 1.8 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
  1. Notify Architect and Owner no fewer than two weeks in advance of proposed interruption of fire-alarm service.
  2. Do not proceed with interruption of fire-alarm service without Owner's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

#### 1.9 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 SYSTEMS OPERATIONAL DESCRIPTION

## 2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways 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."

## 2.4 FIRE-ALARM CONTROL UNIT

- A. Existing with programming, battery, and other upgrades as required.
- B. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
  - 1. Pathway Class Designations: NFPA 72, Class D.
  - 2. Pathway Survivability: Level 1.
  - 3. Install no more than 100 addressable devices on each signaling-line circuit.
- C. Smoke-Alarm Verification:
  - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
  - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  - 3. Record events by the system printer.
  - 4. Sound general alarm if the alarm is verified.
  - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- D. Notification-Appliance Circuit:
  - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  - 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
  - 3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- E. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium. Upgrade existing as required to handle new devices..

## 2.5 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
  1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.

## 2.6 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
  1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be four-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    - c. Multiple levels of detection sensitivity for each sensor.
    - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
  1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).

- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
  - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).
  - 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
  - 4. Each sensor shall have multiple levels of detection sensitivity.
  - 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
  - 6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.7 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
  - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
  - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.8 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  - 1. Connect new equipment to existing control panel in existing part of the building.
  - 2. Expand, modify, and supplement existing control equipment as necessary to extend existing control functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Manual Fire-Alarm Boxes:



1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.3 PATHWAYS

A. Pathways above recessed ceilings and in nonaccessible locations may be routed exposed.

1. Exposed pathways located less than 96 inches (2440 mm) above the floor shall be installed in EMT.

B. Pathways shall be installed in EMT.

C. Exposed EMT shall be painted red enamel.

## 3.4 CONNECTIONS

- A. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

## 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

## 3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

## 3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.

6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

END OF SECTION 283111