PROJECT MANUAL
CONSTRUCTION DOCUMENTS

CENTRAL HOUSE AND GARDEN

BENTONVILLE, ARKANSAS

October 2, 2026



Landscape Architect
Dirtworks

Architect
WER Architects

Civil
Crafton Tull & Associates, Inc

Mechanical/Electrical/Plumbing/Fire Protection
Insight Engineering, PLLC

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ENFRA TME, LLC

Food Service Consultant
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Acoustical Engineers
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Dirtworks WER ARCHITECTS

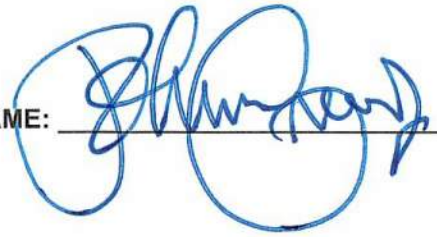
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SECTION 00 0105
CERTIFICATIONS PAGE

ARCHITECT

I HEREBY CERTIFY THAT THIS PROJECT MANUAL WAS PREPARED BY ME, OR UNDER MY DIRECT SUPERVISION, AND THAT I AM A DULY LICENSED ARCHITECT UNDER THE LAWS OF THE STATE OF ARKANSAS.



NAME: _____ DATE: 10/2/2026 REG. NO C-44

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AVAILABLE PROJECT INFORMATION

PART 1 GENERAL V.22

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available for review, but may or may not be part of Contract Documents, including the following:

B. Site and Utility Survey: Sheet C-002, by Crafton, Tull & Associates, dated May 23, 2025.
   1. Original copy is bound into the project drawings.
   2. This survey identifies grade elevations prepared primarily for the use of Landscape Architect in establishing new grades and identifying natural water shed.

C. ALTA/ NSPS Land Title Survey: Two (2) sheets, dated March 19, 2020 by CEI Engineering Associates, Inc.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.
   2. This survey represents an ALTA/NSPS Land Title Survey of the parcel recorded in public records of Benton County, Arkansas. It identifies existing structures, boundary lines, easements, and setback requirements for construction.

D. Geotechnical Report: Entitled "Report of Subsurface Exploration and Geotechnical Evaluation, 606 Central Ave. Development, Bentonville, Arkansas", by Building & Earth Sciences, LLC and dated May 27, 2026.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.
   2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in Contract Documents.
   4. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Price accruing to Owner.

E. Hazardous Material Survey: Entitled Asbestos Inspection Report for Residential Structure and Outbuilding, 606 E. Central Avenue, Bentonville, AR, dated January 29, 2025 by Snyder Environmental, LLC.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.

F. Hazardous Material Survey: Entitled IDAQ Mold Investigation Report for Residential Structure, 606 E. Central Avenue, Bentonville, AR, dated January 28, 2025 by Snyder Environmental, LLC.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.

G. Existing Conditions Surveys:
   1. Home Inspection Report for 606 E. Central, Bentonville, AR, dated January 21, 2025, by Frank Putnam.
   2. 606 E. Central Gardens Conditions Assessment Report, dated September 18, 2025, by WER Architects and Insight Engineering.
   3. Original copies are available for inspection at Owner's offices during normal business hours. Digital copies are available upon request.

H. Traffic Study: Entitled Traffic Impact Analysis (TIA) for 606 & 612 E. Central Avenue, Bentonville, AR (Scoping Memo), dated April 10, 2026 by Traffic Engineering Consultants, Inc.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.

I. Acoustics Report: Entitled DD Acoustics Report for 606 Central Restaurant Renovation, Bentonville, AR, dated July 29, 2026 by Acentech, Inc.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copy is available upon request.

J. Tree Assessment: Entitled Bud Walton Tree Inventory Map (1 page) and Tree Inventory List (excel file), dated January 28, 2025 by Crafton, Tull & Associates.
   1. Original copy is available for inspection at Owner's offices during normal business hours. Digital copies are available upon request.

1.02 PERMITS AND APPROVALS

A. Owner has obtained the following permits and/or approvals, that are required to be secured prior to commencement of construction work on this project:
   1. Planning commission approvals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

3.01 OBTAINMENT OF PERMITS

A. Owner will obtain the following permits, at no cost to the Contractor:
   1. Large Scale Development Approval.
   2. Storm Water Polution Prevention Plan (SWPPP).

B. Contractor to obtain the following required permits, at no cost to Owner:
   1. Building Permit for all trades.
   2. Demolition Permit.

C. Building Permit Procedures: When required to obtain this permit:
   1. Complete and file permit application(s) with appropriate agency.
   2. Pay required fees.
   3. Advise Architect if submission of modified documents is necessary to have the authorities having jurisdiction complete the plan review and approval process. Submit modified documents expeditiously.
   4. Do not commence execution of any item of work for which a permit has not been obtained.

END OF SECTION

SECTION 00 7200
GENERAL CONDITIONS

V.22 FORM OF GENERAL CONDITIONS

1.01 THE AIA A201-2007 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION APPLICABLE TO THIS CONTRACT IS ATTACHED FOLLOWING THIS PAGE.

END OF SECTION

DRAFT

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

as

EXHIBIT A

TABLE OF ARTICLES

1 GENERAL PROVISIONS

2 OWNER

3 CONSTRUCTION MANAGER

4 ARCHITECT

5 SUBCONTRACTORS

6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

7 CHANGES IN THE WORK

8 TIME

9 PAYMENTS AND COMPLETION

10 PROTECTION OF PERSONS AND PROPERTY

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12 UNCOVERING AND CORRECTION OF WORK

13 MISCELLANEOUS PROVISIONS

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

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

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

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General Conditions of the Contract for Construction

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The term Contract Documents is defined in Section 1.1 of the Agreement.

§ 1.1.2 The Contract

The term Contract is defined in Section 1.1 of the Agreement.

§ 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 Construction Manager to fulfill the Construction Manager's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project, as defined in the Agreement, further means 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.

§ 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 Construction Manager. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Construction Manager 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

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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 Construction Manager 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 Construction Manager, 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 reserved rights.

§ 1.5.2 The Construction Manager, 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 Construction Manager, 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.

§ 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..

§ 1.8 Building Information Models Use and Reliance

Not used.

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.

§ 2.1.2 The Owner shall furnish to the Construction Manager, within thirty (30) days after receipt of a written request, information necessary and relevant for the Construction Manager to evaluate, give notice of, or enforce

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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 Not used.

§ 2.2.2 Not used.

§ 2.2.3 Not used.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Construction Manager shall keep the information confidential and shall not disclose it to any other person. However, the Construction Manager 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 Construction Manager 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. The Construction Manager and its Subcontractors shall execute Owner's Non-Disclosure/Confidentially Agreement attached as Exhibit E to the Agreement. This Section 2.2.4 shall survive the termination of this Agreement.

The receiving party may disclose "confidential" or "business proprietary" information after 7 days' notice to the other party, when required by law, arbitrator's order, or court order, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or to the extent such information is reasonably necessary for the receiving party to defend itself in any dispute. The receiving party may also disclose such information to its employees, consultants, or contractors in order to perform services or work solely and exclusively for the Project, provided those employees, consultants and contractors are subject to the restrictions on the disclosure and use of such information as set forth in this Section 2.2.4.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Construction Manager 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 architect whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish the Construction Manager with a standard survey.

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

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Construction Manager 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 Construction Manager 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 Construction Manager to stop the Work, or any portion

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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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager shall pay the difference to the Owner. If the Construction Manager disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Construction Manager may file a Claim pursuant to Article 15.

ARTICLE 3 CONSTRUCTION MANAGER

§ 3.1 General

§ 3.1.1 The Construction Manager 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 Construction Manager shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Construction Manager shall designate in writing a representative who shall have express authority to bind the Construction Manager with respect to all matters under this Contract. The term "Construction Manager" means the Construction Manager or the Construction Manager's authorized representative.

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

§ 3.1.3 The Construction Manager 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, if any, or by tests, inspections or approvals required or performed by persons or entities other than the Construction Manager.

§ 3.2 Review of Contract Documents and Field Conditions by Construction Manager

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

§ 3.2.3 The Construction Manager 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 Construction Manager shall promptly report to the Owner any nonconformity discovered by or made known to the Construction Manager as a request for information in such form as the Owner may require.

§ 3.2.4 If the Construction Manager believes that additional cost or time is involved because of clarifications or instructions the Owner issues in response to the Construction Manager's notices or requests for information, the Construction Manager shall submit Claims as provided in Article 15. If the Construction Manager fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Construction Manager shall pay such costs and damages to the Owner,

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subject to Section 15.1.7, as would have been avoided if the Construction Manager had performed such obligations. If the Construction Manager performs those obligations, the Construction Manager 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 Construction Manager shall supervise and direct the Work, using the Construction Manager's best skill and attention. The Construction Manager 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 Construction Manager 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 Construction Manager determines that such means, methods, techniques, sequences or procedures may not be safe, the Construction Manager shall give timely notice to the Owner, and shall propose alternative means, methods, techniques, sequences, or procedures. The Owner and Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect or Owner objects to the Construction Manager's proposed alternative, the Construction Manager shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

§ 3.3.3 The Construction Manager 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 Construction Manager 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 Owner in accordance with Section 3.12.8 or ordered in accordance with Section 7.4, the Construction Manager 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 Construction Manager shall enforce strict discipline and good order among the Construction Manager's employees and other persons carrying out the Work. The Construction Manager shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Construction Manager warrants to the Owner that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Construction Manager 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 Construction Manager's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Construction Manager, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Owner, the Construction Manager 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.

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§ 3.6 Taxes

The Construction Manager shall pay sales, consumer, use and similar taxes for the Work provided by the Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Construction Manager shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Construction Manager 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 Construction Manager 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 or Owner will promptly investigate such conditions and, if the Architect or Owner determines that they differ materially and cause an increase or decrease in the Construction Manager's cost of, or time required for, performance of any part of the Work, may recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Owner 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 Owner shall promptly notify the Construction Manager, stating the reasons. If either party disputes the Owner'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 Construction Manager encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Construction Manager shall immediately suspend any operations that would affect them and shall notify the Owner. Upon receipt of such notice, the Owner shall take any action necessary to obtain governmental authorization required to resume the operations. The Construction Manager 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 Construction Manager 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 Construction Manager shall not be required to employ persons or entities to whom the Construction Manager has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Construction Manager of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Construction Manager'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

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costs and the allowances under Section 3.8.2.1 and (2) changes in Construction Manager'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 Construction Manager 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 Construction Manager, and communications given to the superintendent shall be as binding as if given to the Construction Manager.

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

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

§ 3.10 Construction Manager's Construction and Submittal Schedules

§ 3.10.1 The Construction Manager, promptly after being awarded the Contract, shall submit for the Owner's information the Construction Manager's critical path method 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 should account for inclement weather days as defined in 15.1.6 and jointly agreed upon schedule float days to account for unknown project impacts. 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 Construction Manager, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule to the Owner for the Owner's and Architect's approval. The approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Construction Manager's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Construction Manager fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

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§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager represents to the Owner and Architect that the Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager needs to provide such services in order to carry out the Construction Manager's responsibilities for construction means, methods, techniques, sequences, and procedures. The Construction Manager 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 Construction Manager by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Construction Manager shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Construction Manager 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

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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 Construction Manager 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 Construction Manager's design professional to certify that the Work has been performed in accordance with the design criteria, the Construction Manager shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager shall remove waste materials, rubbish, the Construction Manager's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Construction Manager 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 Construction Manager.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

The Construction Manager shall pay all royalties and license fees. The Construction Manager shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner 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 Construction Manager, the Construction Manager 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 Construction Manager shall indemnify and hold harmless the Owner and agents and employees of Owner 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 intentional or negligent acts or omissions of the Construction Manager, 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

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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 Construction Manager, 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 Construction Manager 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. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 Intentionally Not Used

§ 4.2.2 Subject to and as specified in the professional services agreement between Owner and Architect, 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 Construction Manager's rights and responsibilities under the Contract Documents.

§ 4.2.3 Subject to and as specified in the professional services agreement between the Owner and Architect, 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 Construction Manager, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Construction Manager'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 Construction Manager, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Construction Manager may but are not required to include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner may, at Owner's sole discretion, notify the Architect of the substance of any direct communications between the Owner and the Construction Manager 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 Construction Manager. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Payment terms are addressed in Article 7 of the Agreement.

§ 4.2.6 The Architect, with Owner's agreement, has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, with Owner's agreement, 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 Construction Manager, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 Subject to and as specified in the professional services agreement between the Owner and Architect, the Architect will review and approve, or take other appropriate action upon, the Construction Manager's submittals such as Shop Drawings, Product Data, and Samples. The Architect's action will be taken in accordance with the submittal schedule approved by the Owner and 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. The Architect's review of the Construction Manager's submittals shall not relieve the Construction Manager 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 If the Owner agrees, 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, if directed by the Owner, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 If the Owner agrees, 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 Construction Manager 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 Construction Manager of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 Upon written request and approval the Architect may interpret and decide matters concerning performance under, and requirements of, 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.

§ 4.2.12 Interpretations and decisions of the Architect, as agreed to by Owner, 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 the Construction Manager.

§ 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 and if Owner agrees.

§ 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 the 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 with Owner's agreement.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Construction Manager 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 Construction Manager, as soon as practicable after award of the Contract, shall notify the Owner 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

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receipt of the information, the Owner may notify the Construction Manager whether the Owner (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 Construction Manager shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Construction Manager shall not be required to contract with anyone to whom the Construction Manager has made reasonable objection.

§ 5.2.3 If the Owner has reasonable objection to a person or entity proposed by the Construction Manager, the Construction Manager shall propose another to whom the Owner 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 Construction Manager has acted promptly and responsively in submitting names as required.

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

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Construction Manager shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Construction Manager by terms of the Contract Documents, and to assume toward the Construction Manager all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Construction Manager, by these Contract Documents, assumes toward the Owner. Each subcontract agreement shall preserve and protect the rights of the Owner 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 Construction Manager that the Construction Manager, by the Contract Documents, has against the Owner. Where appropriate, the Construction Manager shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Construction Manager 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 Construction Manager 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 Construction Manager; 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 Construction Manager'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.

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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.

§ 6.1.2 Not Used.

§ 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 Construction Manager, who shall cooperate with them. The Construction Manager shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Construction Manager 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 Construction Manager, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Not Used.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Construction Manager 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 Construction Manager's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Construction Manager's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Construction Manager shall, prior to proceeding with that portion of the Work, promptly notify the Owner 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 Construction Manager's Work. Failure of the Construction Manager to notify the Owner 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 Construction Manager's Work. The Construction Manager 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 Construction Manager shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Construction Manager's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Construction Manager for costs the Construction Manager incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Construction Manager shall promptly remedy damage that the Construction Manager 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 Construction Manager in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Construction Manager, 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 Owner will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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§ 7.1.2 A Change Order shall be based upon agreement among the Owner and the Construction Manager. A Construction Change Directive shall be issued as directed by the Owner and may or may not be agreed to by the Construction Manager.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Construction Manager 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 Owner and signed by the Owner and Construction Manager, 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 that Owner directs to be issued and it shall be signed by the Owner, 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 Construction Manager does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Owner 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 Construction Manager shall keep and present, in such form as the Owner 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 Construction Manager 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 Construction Manager disagrees with the adjustment in the Contract Time, the Construction Manager may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Construction Manager shall promptly proceed with the change in the Work involved and advise the Owner of the Construction Manager's agreement or disagreement with

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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 Construction Manager indicates the Construction Manager'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 Construction Manager 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 Owner. 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 Construction Manager may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Owner will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Owner determines, in the Owner's judgment, to be reasonably justified. The Owner'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 Construction Manager agree 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 Owner will direct the preparation of 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, with Owner's approval, 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 Construction Manager believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Construction Manager shall notify the Owner and shall not proceed to implement the change in the Work. If the Construction Manager 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 Construction Manager 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 Construction Manager confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Construction Manager 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 Construction Manager and Owner.

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

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§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Construction Manager 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 Construction Manager's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Construction Manager asserts, and the Architect determines, justify delay, then the Contract Time but not the Contract Sum 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 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 Construction Manager 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 Construction Manager, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

The Schedule of Values is defined and addressed in Section 7.1 of the Agreement.

§ 9.3 Applications for Payment

§ 9.3.1 Applications for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 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 Construction Manager does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Construction Manager, 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 Certificates for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 9.4.2 Certificates for Payment procedures are addressed in Section 7.1 of the Agreement.

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§ 9.5 Decisions to Withhold Certification

§ 9.5.1 Certification for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 9.5.2 Certification for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 9.5.3 Certification for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 9.5.4 Certification for Payment procedures are addressed in Section 7.1 of the Agreement..

§ 9.6 Progress Payments

§ 9.6.1 Certificates for Payment procedures are addressed in Section 7.1 of the Agreement.

§ 9.6.2 The Construction Manager 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 Construction Manager on account of the Subcontractor's portion of the Work. The Construction Manager 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 shall not, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Construction Manager 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 Construction Manager that the Construction Manager has properly paid Subcontractors and suppliers amounts paid by the Owner to the Construction Manager for subcontracted Work. If the Construction Manager 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 Construction Manager'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 Construction Manager provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Construction Manager for Work properly performed by Subcontractors or provided by suppliers shall be held by the Construction Manager for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Construction Manager for which payment was made by the Owner.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Construction Manager 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 Construction Manager. If approved by the applicable court, when required, the Construction Manager 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 Owner does not pay the Construction Manager within thirty (30) days after the date established in the Agreement, the undisputed amount due or the amount awarded by binding dispute resolution, then the Construction Manager 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 Construction Manager's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

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§ 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, which includes issuance of a certificate of occupancy for the Project if required by applicable law prior to occupancy at the location of the Project.

§ 9.8.2 When the Construction Manager considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Construction Manager shall prepare and submit to the Owner 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 Construction Manager to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Construction Manager's list, the Owner will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Owner's inspection discloses any item, whether or not included on the Construction Manager'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 Construction Manager shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Owner. In such case, the Construction Manager shall then submit a request for another inspection by the Owner to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect, with Owner's agreement, will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of Construction Manager for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Construction Manager 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, upon agreement by Owner, shall be submitted to the Construction Manager for written acceptance of responsibilities assigned in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make the progress payment for achievement of Substantial Completion. 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 Construction Manager, 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 Construction Manager 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 Construction Manager considers a portion substantially complete, the Construction Manager shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Construction Manager 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 Construction Manager or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, 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 Construction Manager's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect as directed by Owner will promptly

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make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed and the Owner agrees, 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 Construction Manager 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 Construction Manager's being entitled to final payment have been fulfilled. Owner shall make payment of retainage applying to the Work or designated portion thereof upon Construction Manager's achievement of final completion, but not before.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Construction Manager submits to the Owner and 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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager or by issuance of Change Orders affecting final completion, and the Owner so agrees, the Owner shall, upon application by the Construction Manager 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 Construction Manager to the Owner and 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 Construction Manager, 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 Construction Manager 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 Construction Manager shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

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.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 Construction Manager, 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 Construction Manager 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 Construction Manager 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 Construction Manager shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Construction Manager 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 Construction Manager, 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 Construction Manager is responsible under Sections 10.2.1.2 and 10.2.1.3. The Construction Manager 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 Construction Manager. The foregoing obligations of the Construction Manager are in addition to the Construction Manager's obligations under Section 3.18.

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

§ 10.2.7 The Construction Manager 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 Construction Manager is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Construction Manager 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 Construction Manager, the Construction Manager 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 Construction Manager's notice, the Owner shall, if Owner deems it necessary, obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Construction Manager 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

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Construction Manager 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 Construction Manager and 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 Construction Manager has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Construction Manager has 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 Construction Manager. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Construction Manager'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 Construction Manager 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 Construction Manager 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 Construction Manager's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Construction Manager shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Construction Manager brings to the site and negligently handles, or (2) where the Construction Manager 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 Construction Manager, the Construction Manager 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 Construction Manager for all cost and expense thereby incurred.

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Construction Manager's Insurance and Bonds

§ 11.1.1 The Construction Manager 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 Construction Manager 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 shall be named as an additional insured under the Construction Manager's commercial general liability policy or as otherwise described in the Contract Documents. The Construction Manager's certificate of insurance is attached to the Agreement as Exhibit F.

§ 11.1.2 The Construction Manager 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 Construction Manager 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 Construction Manager shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

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§ 11.1.4 Notice of Cancellation or Expiration of Construction Manager's Required Insurance. Within three (3) business days of the date the Construction Manager becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Construction Manager shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Construction Manager, 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 Construction Manager. The furnishing of notice by the Construction Manager shall not relieve the Construction Manager 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. 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, the Owner shall inform the Construction Manager in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Construction Manager may delay commencement of the Work and may obtain insurance that will protect the interests of the Construction Manager, 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 Construction Manager, 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 Construction Manager is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Construction Manager 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 Construction Manager of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Construction Manager: (1) the Construction Manager, 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 Construction Manager; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Construction Manager, 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 Construction Manager 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 Construction Manager 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 Construction Manager, 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.

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

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

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Construction Manager 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 Construction Manager their just shares of insurance proceeds received by the Owner, and by appropriate agreements and Construction Manager shall make payments to Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Construction Manager of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Construction Manager shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Construction Manager does not object, the Owner shall settle the loss and the Construction Manager 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 Construction Manager shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Construction Manager 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 Construction Manager 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 Owner's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Owner, be uncovered for the Owner's examination and be replaced at the Construction Manager's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Owner has not specifically requested to examine prior to its being covered, the Owner may request to see such Work and it shall be uncovered by the Construction Manager. If such Work is in accordance with the Contract Documents, the Construction Manager 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 Construction Manager's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Construction Manager shall promptly correct Work rejected by the Owner 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 Construction Manager's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Construction Manager'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

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Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Construction Manager shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Construction Manager 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 Construction Manager and give the Construction Manager an opportunity to make the correction, the Owner waives the rights to require correction by the Construction Manager and to make a claim for breach of warranty. If the Construction Manager fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner, 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 Construction Manager pursuant to this Section 12.2.

§ 12.2.3 The Construction Manager 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 Construction Manager nor accepted by the Owner.

§ 12.2.4 The Construction Manager shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Construction Manager'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 Construction Manager 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 Construction Manager 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 Construction Manager's liability with respect to the Construction Manager'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 laws of the State of Arkansas, 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 Construction Manager 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 Construction Manager, 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 Construction Manager 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.

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§ 13.3.2 No action or failure to act by the Owner, Architect, or Construction Manager 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 Construction Manager 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 Construction Manager shall pay for any and all fees for cancelled test. The Construction Manager shall give the Owner timely notice of when and where tests and inspections are to be made so that the Owner 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 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 Construction Manager to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Construction Manager shall give timely notice to the Owner and Architect of when and where tests and inspections are to be made so that the Owner and 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 Construction Manager's expense.

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

§ 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 Construction Manager

§ 14.1.1 The Construction Manager may terminate the Contract if the Work is stopped for a period of sixty (60) consecutive days through no act or fault of the Construction Manager, 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 Construction Manager 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

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.4 Not used.

§ 14.1.2 The Construction Manager may terminate the Contract if, through no act or fault of the Construction Manager, 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 Construction Manager may, upon thirty (30) days' notice to the Owner, 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 sixty (60) consecutive days through no act or fault of the Construction Manager, 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 material obligations under the Contract Documents with respect to matters important to the progress of the Work, the Construction Manager may, upon thirty (30) additional days' notice to the Owner, 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 Construction Manager

.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 Construction Manager 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 breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Construction Manager and the Construction Manager's surety, if any, seven days' notice, terminate employment of the Construction Manager and may, subject to any prior rights of the surety:

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

.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 Construction Manager, the Owner shall furnish to the Construction Manager 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 Construction Manager 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 Construction Manager. If such costs and damages exceed the unpaid balance, the Construction Manager shall pay the difference to the Owner. The amount to be paid to the Construction Manager 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. In the event the Owner improperly terminates the Contract pursuant to Section 14.2.2 above, such termination shall be automatically converted to a termination for convenience under Section 14.4 below.

§ 14.3 Suspension by the Owner for Convenience

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

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§ 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 Construction Manager 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 Construction Manager 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 Construction Manager for Work properly executed; and costs incurred by reason of the termination, including costs attributable to termination of Subcontracts..

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 Construction Manager 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 Construction Manager 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 Construction Manager 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 Construction Manager, 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. 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 Construction Manager, 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 Construction Manager shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

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§ 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 Construction Manager 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 Construction Manager wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Construction Manager'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.

§ 15.1.6.3 For claims related specifically to "Precipitation Days", the following table of normal Precipitation days will be employed to determine if the Contractor is entitled to a time extension. A "Precipitation Day" is defined as a 24-hour period in which 1/10" (0.1) of precipitation or more falls, causes a loss of equal to or greater than 4 hours of a planned, critical path workday and is shown to delay the final completion date. Precipitation will be measured in a rain gauge at the project site and recorded in the Contractor's daily reports. Precipitation Days will be calculated based on any surplus of actual-less-normal during a given month.

Average Days with 1/10" of Precipitation or More: Central Arkansas
- January (8), February (8), March (9), April (10), May (11), June (9), July (7), August (7), September (7), October (7), November (7), December (7).

§ 15.1.6.4 Days per month which may not be available for construction may be further defined as days lost to Inclement Weather in which the project site is inaccessible due to the inclement weather beyond the day of the incident, causing a loss of equal to or greater than 4 hours of a planned, critical path workday and is shown to delay the final completion date. Examples of Inclement Weather days would include: Frozen ground, mud, colder temperatures than specifications allow concrete and masonry work to proceed, rain, snow, sleet, ice, frozen precipitation accumulated on the work surfaces, lightning, and excessive wind. Inclement Weather days will be recorded in the Contractor's daily reports.

§ 15.1.6.5 Documentation of delays for Precipitation Days and Inclement Weather Days as defined and recorded in 15.1.6.3 and 15.1.6.4 will be submitted with the Contractor's monthly payment application for review. Claims for additional time will be submitted periodically as the work progresses and as warranted based on actual job progress as compared with the project schedule. Acceptance of claims for additional time due to Precipitation Days and Inclement Weather Days in of itself, does not constitute grounds for additional General Conditions and General Requirements costs.

§ 15.1.7 Waiver of Claims for Consequential Damages

Not used.

§ 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 Owner 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 Construction Manager and persons or entities other than the Owner.

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§ 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; and (2) state the reasons therefor. 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 Construction Manager, 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 Construction Manager's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

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

§ 15.3 Mediation

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

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

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

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in Benton County, Arkansas. 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 Benton County, Arkansas. 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 Construction Manager 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 Construction Manager under this Agreement.

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SECTION 01 1000
SUMMARY

PART 1 GENERAL V.22

1.01 PROJECT

A. Project Name: Central House and Garden.

B. Project Address: 606 E. Central, Bentonville, AR

C. Owner's Name: Peel Compton Foundation.

D. Architect: WER Architects.

E. The Project consists of the rehabilitation of a 7-acre residential property as a park/recreation area with a restaurant as a park amenity.
   1. The Project includes construction of parking lots, pathways, formal gardens, a pool/water feature, a pedestrian bridge, boardwalks, plantings, and other site features.
   2. The Project includes the following structures:
      a. Main Building: Existing two-story house to receive a new addition and to be rehabilitated as a restaurant and business offices.
      b. Maintenance Building: Existing one-story freestanding garage to be rehabilitated as maintenance office and storage.
      c. Greenhouse: New one-story freestanding prefabricated horticultural building.
      d. Garden Shed: New one-story freestanding storage building.

1.02 WORK BY OWNER

A. Responsibility Matrix: Refer to the Responsibility Maxtrix following this section for components to be Owner Furnished/Owner Installed (OFOI), Owner Furnished/Contractor Installed (OFCI), or Contractor Furnished/Contractor Installed.

B. The Owner, without sacrificing their right to do so, does not plan to undertake significant work with their own forces within the construction site prior to Substantial Completion.

C. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion.

D. Items and equipment noted to be Contactor Furnished and Contractor Installed are to be purchased new by the Contractor and all cost associated with the handling, installation and connection should be included turn-key in the project. All items and equipment noted to be Contractor Installed shall be coordinated with provider and the Contractor shall include all costs for handling, installation and connection in the project.

E. Cooperate fully with the Owner's own forces or separate contractors, if any, so work on those contracts may be carried out smoothly, without interfering with or delaying work under this contract.

1.03 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Arrange use of site and premises to allow:
   1. Work by Others.
   2. Work by Owner.

C. Do not unreasonably encumber site with materials or equipment. Confine stockpiling of materials to areas authorized by Owner.

D. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

E. Noise Restrictions:
   1. Noise Ordinance: Comply with City of Bentonville Municipal Code (Article 58) pertaining to restriction of sound levels based on decible limits and time of day.
      a. R1 Zoning Sound Limits:
         1) 7:00 am - 10:00 pm: 60 dB(A)
         2) 10:00pm - 7:00am: 55 dB(A)

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

RESPONSIBILITY MATRIX

RESPONSIBILITY MATRIX	OWNER FURNISHED OWNER INSTALLED	OWNER FURNISHED CONTRACTOR INSTALLED	CONTRACTOR FURNISHED CONTRACTOR INSTALLED	F&B TENANT FURNISHED & INSTALLED	10/2/2026
ITEM	**OFOI**	**OFCI**	**CFCI**	**F&B**	**COMMENTS**
AV SYSTEMS					
Conduits, raceways, & backboxes			X		
System Cabling & Device Termination			X		
Speakers			X		By A/V subcontractor
Speaker mounts			X		By A/V subcontractor
Control devices			X		By A/V subcontractor
TV (second floor conference room)		X			
TV Mount			X		
In wall blocking			X		
Tele/Data (Structured Cabling)					
Service to Site - Fiber			X		
Conduits, trays, raceways, & backboxes			X		
Telephone Outlets (VOIP)			X		Cat 6A
System Cabling & Device Termination			X		Cat 6A
Racks, Patch Panels			X		
UPS	X				
Switches & crossover cables	X				
Wireless Access Devices	X				
PoE Injectors & switches	X				
Servers					
CCTV Security					
Conduits, raceways, & backboxes			X		
System cabling & Device Termination			X		
Cameras			X		By security subcontractor
Head-end equipment			X		By security subcontractor
Intrusion Detection System/Alarm			X		By security subcontractor
Fire Alarm					
Conduits, raceways, & backboxes			X		
System and cabling			X		
Restaurant Devices					
Conduits, raceways, & backboxes					
Point-of-sale devices				X	
POS Connection/Data Port			X		With Structured Cabling
Menus				X	
In wall blocking			X		
Kitchen Equipment & Appliances					
Kitchen Equipment			X		
Kitchen Vendor Equipment (Rental)				X	
Kitchenware (dishes, glassware, pots, utensils, etc.)				X	
Janitorial					
Toilet accessories			X		
In wall blocking			X		
Furniture, Fixtures and Equipment					
House furnishings, rugs		X			
Site furnishings, benchs, bike racks			X		
AED Devices			X		
Fire Extinguishers			X		
Storage Room Shelving			X		
Employee Lockers			X		

RESPONSIBILITY MATRIX	OWNER FURNISHED OWNER INSTALLED	OWNER FURNISHED CONTRACTOR INSTALLED	CONTRACTOR FURNISHED CONTRACTOR INSTALLED	F&B TENANT FURNISHED & INSTALLED	10/2/2026
ITEM	**OFOI**	**OFCI**	**CFCI**	**F&B**	**COMMENTS**
Artwork					
House artwork	X				
In wall blocking			X		
Site sculpture	X				
Concrete pads & mounts for sculpture			X		
Horticultural Equipment			X		By greenhouse sub-contractor
Miscellaneous					
Lighting control systems			X		
Shade control systems			X		
Site irrigation control systems			X		

SECTION 01 1210
ASBESTOS PRECAUTIONS AND PROCEDURES

PART 1: GENERAL

1.01 SECTION INCLUDES:

A. Contractor's responsibilities concerning asbestos containing materials (ACM) in the existing building or system where work is to occur.

B. Contractor's responsibilities concerning asbestos in materials, products, and equipment used in the construction project.

1.02 DISCOVERY OF ASBESTOS CONTAINING MATERIALS (ACM):

A. Unless indicated otherwise within the construction documents. There are no known ACM's present within the construction limits.

B. During the construction project, the Contractor shall notify the Owner of any portion of the work which the Contractor knows or has reason to believe contains asbestos. The Contractor shall take necessary precautions to prevent damage and release of asbestos fibers to the air.

C. Any asbestos abatement procedures shall be performed by the Owner under a separate contract.

1.03 ASBESTOS CONTAINING MATERIALS AND PRODUCTS:

A. All building construction materials, products, and equipment used in the project shall be asbestos free.

B. The Contractor shall be responsible for verifying with suppliers and manufacturers that construction materials, products, and equipment used in completion of the project are asbestos free.

C. The Contractor shall provide certification (typewritten, signed and dated) to the Owner indicating that asbestos free materials, products and equipment was used in completion of the work.

PART 2: PRODUCTS NOT APPLICABLE.

PART 3: EXECUTION NOT APPLICABLE.

END OF SECTION

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Cash allowances.

B. Payment and modification procedures relating to allowances.

1.02 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or subcontractor, less applicable trade discounts.

B. Costs Not Included in Cash Allowances: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of products from elements and from damage; product mark-up; cost of installation materials; and labor for installation and finishing. All the aforementioned costs shall be included in the base bid for the project, unless noted otherwise in the Allowances Schedule below..

C. Architect Responsibilities:
   1. Consult with Contractor for consideration and selection of products, suppliers , and installers.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Architect in selection of products, suppliers , and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of which products have been selected, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

1.03 ALLOWANCES SCHEDULE

A. Section 09 3000 - Tiling: Include the stipulated sum of $25.00 per square foot for purchase and delivery of PCT-01 Porcelain Tile. Material cost only; allowance excludes dealer markup, installation materials, and labor..

B. Section 09 6816 - Carpeting: Include the stipulated sum of $45.00 per square yard for purchase and delivery of CPT-01 Carpet Tile.Material cost only; allowance excludes dealer markup, installation materials, and labor..

C. Section 09 6816 - Carpeting: Include the stipulated sum of $25.00 per square yard for purchase and delivery of CPT-02 Carpet Tile.Material cost only; allowance excludes dealer markup, installation materials, and labor..

D. Section 09 7200 - Wall Coverings: Include the stipulated sum of $30.00 per square foot for purchase and delivery of SWC-01 Specialty Wallcovering.Material cost only; allowance excludes dealer markup, installation materials, and labor..

E. Signage Alloance: Include the stipulated sum/price of $10,000 for architectural signage (exterior and ADA). Allowance includes materials, fabrication, and installation. Allowance excludes landscape-related or site signage, and signage related to restaurant tenant.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2300
ALTERNATES

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Add Alternate No. 1 - Add tape light at boardwalk:

1. Description: Provide approximately 830 linear feet of tape light to be installed along boardwalk kickplate. Work includes one additional 60A electrical panel, conduits, low voltage transformer, low voltage wiring, and accessories.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500.11
SUBSTITUTION REQUEST FORM

V.22 SEND TO:

WER ARCHITECTS / PLANNERS ATTN: JOHN GREER, JR.

901 W. 3RD STREET

LITTLE ROCK, AR 72201

PHONE: 501-374-5300 FAX: 501-374-5247

SECTION:_____PARAGRAPH:_____SPECIFIED ITEM:_____

PROPOSED SUBSTITUTE:_____

ATTACH, COMPLETE DESCRIPTION, DESIGNATION, CATALOG OR MODEL NUMBER, SPEC DATA SHEET, AND OTHER TECHNICAL DATA, INCLUDING LABORATORY TESTS IF APPLICABLE.

ANSWER THE FOLLOWING QUESTIONS:

WILL SUBSTITUTION AFFECT DIMENSIONS INDICATED ON DRAWINGS? IS THE SIZE DIFFERENT PHYSICAL SIZE?

_____

WILL SUBSTITUTION AFFECT WIRING, PIPING, DUCTWORK, ETC. INDICATED ON DRAWINGS? THIS INCLUDES LOWER OR HIGHER ELECTRICAL LOAD AND/OR VOLTAGE; DIFFERENT BTU HEAT LOAD AND/OR OR VENTING; REQUIRED CLEARANCES, ETC.

_____

WHAT AFFECT WILL SUBSTITUTION HAVE ON OTHER TRADES?

_____

LIST ANY DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM:

_____

IF NECESSARY, WILL THE UNDERSIGNED PAY FOR ARCHITECTS/ENGINEER'S COSTS, REQUIRED TO REVISE WORKING DRAWINGS, THAT ARE CAUSED BY SUBSTITUTION?

_____

MANUFACTURER'S WARRANTY OF PROPOSED ITEMS ARE [ ] SAME [ ] DIFFERENT

PROPOSED COST SAVINGS USING SUBSTITUTION PRODUCT:_____

<u>REVIEW COMMENTS</u>:

[ ] APPROVED

[ ] APPROVED AS NOTED (SEE ATTACHED EXPLAINATION)

[ ] NOT APPROVED / REJECTED

[ ] REJECTED / RECEIVED TOO LATE / NOT REVIEWED

REMARKS: _____REVIEWED BY: _____

SUBMITTED BY:

FIRM: _____

ADDRESS: _____

SIGNATURE: _____

DATE: _____

PHONE/EMAIL: _____

END OF SECTION

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 01 2500.11 - Substitution Request Form: Required form for substitution requests made after award of contract (During construction).

B. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. General Clarification: Where a definate material is specified it is not the intent to descriminate against any equal product from another manufacturer. It is the intent to set a definate standard. Open competition is expected, but in all cases, complete data must be submitted for comparrision and test when requested by Architect. No substitution shall be made unless authorized in writing by the Architect. If the Contractor proposes to substitute an equal product, he shall make this fact known, in writing, to the Architect as soon as possible after the award of the contract.

B. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system including aesthetics of physical properites such as available colors, patterns and textures.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. A Substitution Request for specified installer constitutes a representation that the submitter:
   1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.

D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms included in the Project Manual are adequate for this purpose, and must be used.

E. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
   1. Submit substitution requests by completing the form following this Section; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Architect will consider requests for substitutions only within 30 days after date of Agreement.

C. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be recorded into submittal and any required changes to the Construction Documents will be incorporated into the work by issuance of Change Order, Architectural Supplementary Insructions, or similar instruments proivded for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Electronic document submittals.
B. Preconstruction meetings.
C. Site mobilization meetings.
D. Progress meetings.
E. Construction progress schedules.
F. Progress photographs.
G. Change Order requirements.
H. Contractor Liabiltity requirements.
I. Coordination drawings.
J. Submittals for review, information, and project closeout.
K. Number of copies of submittals.
L. Submittal procedures.

1.02 PROJECT COORDINATION

A. Cooperate with the Project Coordinator in allocation of mobilization areas of site; for field offices and sheds, for construction & delivery access, traffic, and parking facilities.
B. During construction, coordinate use of site and facilities through the Project Coordinator.
C. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
D. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
E. Coordinate field engineering and layout work under instructions of the Project Coordinator.
F. Make the following types of submittals to Architect:
    1. Requests for interpretation.
    2. Requests for substitution.
    3. Shop drawings, product data, and samples.
    4. Test and inspection reports.
    5. Design data.
    6. Delgated Design Deferred submittals.
    7. Manufacturer's instructions and field reports.
    8. Applications for payment and change order requests.
    9. Progress schedules.
    10. Coordination drawings.
    11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTALS

A. Any documents transmitted for purposes of administration of the contract will be in electronic (PDF) format and transmitted via an Internet-based e-mail service.
    1. In addition to submittals for review, information, and closeout, this procedure will apply to requests for information (RFIs), progress documentation, contract modification documents

(e.g. supplementary instructions, proposal requests, change orders), applications for payment, field reports and meeting minutes, and any other document the Contractor or Architect wish to make part of the project electronic record.

2. Contractor and Architect will use conventional e-mail for this service, subject to the limitations of the service provider (file size).
3. It is the Contractor's responsibility to submit documents in PDF format via file attachment to e-mail directed to Addressee will be determined at the pre-construction conference. Documents shall be reviewed and stamped by the contractor prior to submission. PDF documents without contractors stamp, signature and/or initials, & date will not be reviewed. Each scan or PDF copy, especially large format documents or drawings, shall be individually stamped, if transmitted as individual files. Assembled documents in a single file need only be stamped once.
4. Subcontractors, suppliers, and Architect's consultants are required to use the e-mail transmission of review documents, and provide copies directed to the Architect and Contractor.
5. Users of the electronic document submission process shall provide an email address and Internet access. PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), is encouraged, unless scan to PDF file capability is provided by the document generator / provider.
6. Paper documents & transmittals of electronic submissions will not be reviewed; emailed PDF documents without transmittal letters / forms from the contractor will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to physical samples or color selection charts.

B. Cost: The cost of the electronic document submittal(s) is to be paid by Contractor; include the cost of the submittals in the contract sum.

C. Project Closeout: Architect will determine which project electronic document files shall be archived for the Owner. The contractor shall provide these documents elecronically and physical components as part of the close out document submission.

3.02 PRECONSTRUCTION MEETING

A. Architect will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect/Landscape Architect.
   3. Contractor.

C. Agenda:
   1. Distribution of Contract Documents.
   2. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   3. Designation of personnel representing the parties to Contract, the Owner and Architect.
   4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   5. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.03 SITE MOBILIZATION MEETING

A. Architect will schedule a meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:
   1. Contractor.
   2. Owner.

3. Architect/Landscape Architect.
4. Contractor's Superintendent.
5. Major Subcontractors.

C. Agenda:
1. Use of premises by Owner and Contractor.
2. Owner's requirements .
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Security and housekeeping procedures.
6. Schedules.
7. Application for payment procedures.
8. Procedures for testing.
9. Procedures for maintaining record documents.
10. Requirements for start-up of equipment.
11. Inspection and acceptance of equipment put into service during construction period.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, Architect/Landscape Architect, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to Work.

E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.05 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. In addition to periodic, recurring views, take photographs of each of the following events:
1. Completion of site clearing.
2. Excavations in progress.
3. Foundations in progress and upon completion.
4. Structural framing in progress and upon completion.
5. Enclosure of building, upon completion.

6. Final completion, minimum of ten (10) photos.

D. Take photographs as evidence of existing project conditions.

3.07 COORDINATION DRAWINGS

A. Provide information required by Project Coordinator for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

3.08 DIGITAL DOCUMENT FILES AND RELEASES

A. BIM Models: Projects are created by Architect and Engineers using Building Information Modelling software and not all projects wil have these files available for Contractor's use. The final model is a composite of multiple models that will require separate models from consultants. Contact Architect and Engineers for specific availablity and cost.

B. AutoCAD files: Do not exist for architectural plans. Architect has capabilty to generate AutoCAD files that resemble the sheets as seen in the Construction Documents as well as generate entire floor plans of the building. This service can be provided at a cost to the Contractor per sheet/floor plan desired. See end of section for Digital Release form.

C. Portable Digital Format (PDF): PDF of issued drawings can be provided to Contractor at no cost. Contact Architect for availablity.

D. Other documents: Contractor will have to directly contact consultants for trade specific files, such as AutoCAD files for topographical layout, etc.

3.09 REQUESTS FOR CHANGE ORDERS

A. In order to facilitate checking of quotations for extras or credits, all proposals, except for those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Labor and materilas shall be itemized in manner prescribed above. Where major cost items are subcontracts, they shall be itemied also.

3.10 CONTRACTOR LIABILITY REQUIREMENTS

A. The Contractor shall cause the commerical liability coverage required by the Contract Documents to include (1) the Owner, the Architect Engineer and the Architect Engineer's consulants as additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caued in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations. The Architect / Engineer, Engineer, and their respective Consultants are responsible for their own Professional Liability coverage.

3.11 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.
   5. Delgated Design Deferred submittals.

B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only for aesthetics, including color or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - CLOSEOUT SUBMITTALS.

3.12 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.

2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Safety Data Sheets.
8. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.13 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

B. Submit for Owner's benefit during and after project completion.

3.14 NUMBER OF COPIES OF SUBMITTALS

A. Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Documents for Information: Submit one electronic copy.

C. Documents for Project Closeout: Make electronic reproductions of submittal files originally reviewed. Include electronic files of any submittals for information. All hard copies of Operational Manuals included with products and equipment should be collected and retained for close out documentation.

D. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect or Landscape Architect.
1. After review, produce duplicates required for jobsite use & verification.
2. Retained samples will not be returned to Contractor unless specifically so stated. Digital documentation of approvided samples will be provided.

3.15 SUBMITTAL PROCEDURES

A. Transmit each submittal with approved form and Contractors transmittal form. Transmittals shall be numbered sequentially and revised submittals should include original number and a sequential alphabetic suffix. Transmittal shall include list of each specification section or sections that are included in the submittal contents. Send transmitted submittal as one complete PDF; multiple files will not be reviewed and will need to be reassembled by Contractor.

B. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number.

C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.

D. Deliver physical submittals to Architect or Landscape Architect at their business address. In some instances, larger physical samples can be coordinated to be delivered to the construction site, typically for use in a mock-up.

E. Schedule submittals to expedite the Project, and coordinate submission of related items. Transmit higher priority submittals first and provide date for anticipated return of submittal.

F. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor. When large quantities of submittals are transmitted in a short time frame, review time may take

longer. Mark high priority submittals on transmittal to notify and assist in an expedited review process.

G. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work. Any proposed change or deviation from Contract Document plans or specifications must be clearly noted and easily identifiable on the submittal. Any change must be identified and specifically requesting approval of proposed deviation by Architect or Engineer of Recod. Failure to follow this requirement results in submitted deviation bearing the complete responsiblity of the contractor.

H. Comments made in submittals by Architect or Engineer that change contract costs must be submitted to Architect as a Potential Change Order for Claims for review and approval by Owner prior to the change to project scope. Failure to follow this requirement, whether a cost savings or cost increase, results in the submitted cost change bearing the complete responsibilty of the providing contractor.

I. Provide space for Contractor and Architect review stamps. Submittals must be reviewed and stamped by Contractor, unstamped submittals will be not be reviewed and will be returned.

J. Submittals are to be as complete, comprehensive and accurate as possible. Include all components requested to be reviewed in Submittal section of the specifications. Do not split up a single specification section into multiple submittals (ie product data, samples, shop drawings, etc.). Avoid grouping unrelated specifications sections together in a submittal.

K. Each submittal will only be reviewed two times; once for orginal review and then a second time for a potential revised submittal. Any further additional reviews must include General Contractor's explaination for their inablity to conform with requirements. Additional reviews beyond the aforementioned may have costs associated to complete additional reviews.

L. When revised for resubmission, identify all changes made since previous submission. Cloud all changes and revised details or notes. Address all comments and/or questions posed in previous submission; lack of addressing all previous review comments are grounds for rejections of submittal. Only submit new or revised items. For revised items, clearly cloud or identify changed components.

M. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

N. Submittals not requested will not be recognized or processed.

3.16 AUTOCAD RELEASE FORM

A. At your request, WER Architects (WER) will provide electronic files for your convenience and use in the preparation of a bid or shop drawings related to Project: _____subject to the following terms and conditions.

B. WER's electronic files are compatible with AutoCad as a dwg. file. WER makes no representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced specifications.

C. Data contained on these electronic files is part of WER's instruments of service and shall not be used by you or anyone else receiving this data through or from you for any purpose other than as a convenience in the preparation of bids or shop drawings for the referenced project. Any other use or reuse by you or by others, will be at your sole risk and without liability or legal exposure to WER. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against WER, its officers, directors, employees, agents or sub-consultants which may arise out of or in connection with your use of the electronic files.

D. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold harmless WER from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from your use of these electronic files.

E. **These electronic files are not contract documents.** Differences may exist between these electronic files and corresponding hard copy contract documents due to addenda, change orders or other revisions. WER makes no presentation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed contract documents prepared by WER and electronic files, the signed contract documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including and without limitations, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

F. Because of the potential that the information presented on the electronic files can be modified, unintentionally or otherwise, WER reserves the right to remove all indications of its ownership and/or involvement from each electronic display.

G. WER will furnish you electronic files at a cost of **$150.00** per building floor or sheet, for the following:

1. _____
2. _____
3. _____

A service fee of $ (_____) shall be remitted to WER prior to delivery of the electronic files.

H. Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by WER and WER makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall WER be liable for any loss of profit or any consequential damages.

SIGNED: _____ _____

WER ARCHITECTS **CONTRACTOR NAME / TITLE**

_____

_____

DATE: _____ **ADDRESS / PHONE NUMBER**

END OF SECTION

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule at Construction Progress Meetings.

1.03 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.04 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches. Provide electronic file(s) in PDF format.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules where appropriate to define critical portions of the entire schedule.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect/Landscape Architect. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for owner-furnished products.

H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties at Construction Progress Meetings.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01 3591
HISTORIC TREATMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This section includes special procedures for historic treatment on Project including, but not limited to, the following.
   1. Storage and protection of existing historic materials.
   2. Temporary protection of historic materials during construction.
   3. Protection during use of heat-generating equipment.
   4. Historic treatment procedures
   5. Submittals schedule

1.02 REFERENCES

A. The Secretary of the Interior's Standards for the Treatment of Historic Properties (http://www.nps.gov/tps/standards.htm).

1.03 DEFINITIONS

A. Adaptive Reuse: the act or process of reusing existing spaces for a purpose other than which they were originally intended. Adaptive Use allows for alteration as needed to suit the program. Current configuration and finishes need not be retained. Adaptive Use spaces are prime locations to carry the load of mechanical, electrical, and plumbing system upgrades and other code-required work.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Dismantle: To disassemble and detach items by hand from existing construction to the limits indicated, so as to protect nearby historic surfaces.

D. Enhancement: To in increase or improvement upon quality, value, or extent of the original design intent.

E. Existing to Remain: Existing items that are not to be removed or dismantled.

F. Historic: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance, which are important to the successful preservation or restoration as determined by Architect and Owner’s Representative. Designated historic areas and elements are throughout the project, and sometimes specifically indicated on Drawings.

G. Historic Fabric: those portions of a building fabric that have been deemed significant. Also called Original Fabric.

H. Historic Treatment Zones: Spaces, areas, rooms, surfaces, materials, finishes, and overall appearance which are important to the successful preservation, restoration, rehabilitation and/or adaptive reuse have been zoned accordingly. Historic Treatment Zones are indicated on the drawings and are as designated below:
   1. Preservation Zones (Zone 1) are spaces that include public areas of primary architectural/functional importance, retain a high level integrity and original character, and are to be preserved.
   2. Restoration Zones (Zone 2) are spaces that include public areas of primary architectural/functional importance, retain a moderate degree of integrity with significant original materials hidden beneath non-original accretions, and are to be restored.
   3. Rehabilitation Zones (Zone 3) are spaces that include previously altered semi-public and private spaces, possess some historical or architectural significance and/or retain some architectural integrity or historic character, and are to be rehabilitated.
   4. Adaptive Reuse Zones (Zone 4) are spaces that possess little historical or architectural significance and/or retain little architectural integrity or historic character. These spaces were often designed to serve a utilitarian function, although they include some that have

been substantially altered from their original appearance and configuration and are to be adaptively reused.

I. In Kind Material: Material that matches existing materials, as much as possible, in species, cut, color, grain, and finish.

J. Integrity: the authenticity of the building identity, evidenced by the survival of physical characteristics that existed during the period of significance.

K. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

L. Period of Significance: the span of time or times in which the building attained its significance.

M. Preservation: The act or process of applying measures necessary to preserve and sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction.

N. Reconstruction: The act or process of depicting, by means of new work, the form, features, and detailing of non-surviving historic features, or any part thereof, for the purpose of replicating its appearance during the period of significance.

O. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

P. Rehabilitation: The act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values.

Q. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.

R. Remove: Specifically for historic spaces, areas, rooms, and surfaces, the term means to detach an item from existing construction to the limits indicated, using hand tools and hand-operated power equipment.

S. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. Includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

T. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates.

U. Replicate: To reproduce an element or feature in exact detail, materials, and finish.

V. Reproduce: To fabricate or replicate a new item, accurate in detail to the original, and in either the same or a similar material as the original, unless otherwise indicated.

W. Restoration: The act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time by means of maintaining and preserving original features that remain, the removal of features from other periods in its history and reconstruction of missing features from the period of significance.

X. Retain: To keep existing items that are not to be removed or dismantled.

Y. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials.

Z. Salvage: To carefully remove, protect and store original items for potential reuse on the project.

AA. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.

BB. Strip: To remove existing finish down to base material or identified finish layer.

CC. Sympathetic: additions to original designs that are sensitive to the historic character in size, scale, style, and choice of materials. Sympathetic additions need not exactly match the original design exactly.

1.04 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during removal and dismantling work remain the property of the Owner. Carefully dismantle and salvage each item or object and turn them over to the Owner.

B. Coordinate with the COR, who will establish special procedures for dismantling and salvage.

1.05 REQUIRED SUBMITTALS

A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's historic treatment operations.

B. Work Program: Submit as specified in individual Sections, before work begins.

C. Fire Prevention Plan: Prior to use of any heat-generating equipment in historic spaces, prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-prevention devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include each fire watch's training, duties, and authority to enforce fire safety

1.06 QUALITY ASSURANCE

A. Preconstruction Conference: Conduct conference at Project site prior to the commencement of selective demolition work to establish a guide for the scope and extent of temporary protection, and the salvage and repair or reinstallation of any historic fabric.
   1. General: Review methods and procedures related to historic treatment including, but not limited to, the following:
      a. Review and finalize historic treatment construction schedule; verify availability of materials, equipment, and facilities needed to make progress and avoid delays.
      b. Review material application, work sequencing, tolerances, and required clearances.
      c. Review areas where existing construction is to remain and requires protection.
   2. Removal and Dismantling:
      a. Inspect and discuss condition of construction to be removed or dismantled.
      b. Review requirements of other work that relies on substrates exposed by removal and dismantling work.

1.07 STORAGE AND PROTECTION OF HISTORIC MATERIALS

A. Salvaged Historic Materials:
   1. Clean salvaged historic items.
   2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Protect items from damage during transport and storage.
   5. Do not dispose of items removed from existing construction without prior written consent of Owner.

B. Historic Materials for Reinstallation:
   1. Repair and clean historic items as indicated and to functional condition for reuse.
   2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make item functional for use indicated.

C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by the Owner, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after historic treatment and construction work in the vicinity is complete.

D. Storage and Protection: When taken from their existing locations, catalog and store historic items within a weathertight enclosure where they are protected from wetting by rain, snow, condensation, or ground water, and temperature variations.
   1. Identify each item with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
   2. Secure stored materials to protect from theft.

1.08 PROJECT CONDITIONS

A. Owner will occupy portions of building within and immediately adjacent to the work area. Conduct all work so that the Owner's operations will not be disrupted.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Do not proceed with any dismantling or demolition that has not been previously agreed upon unless there is agreement with the Owner.

D. Storage or sale of removed or dismantled items on-site is not permitted, unless otherwise indicated.

E. General Size Limitation in Historic Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

1.09 COORDINATION

A. Coordinate historic treatment procedures of this Section with public circulation patterns at Project site. Public circulation areas cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

PART 2 PRODUCTS

2.01 PROTECTION MATERIALS

A. Temporary protection materials for historic items, materials and finishes may include, but are not limted to, the following:
   1. Polyethylene sheets: 4 mil. thickness minimum.
   2. Lumber: Species to be selected by Contractor, sizes to fit field conditions. All lumber to be fire retardant.
   3. Plywood: Fire retardant, thickness as required.
   4. Soft Fiberboard: Homasote Company or similar.
      a. Homasote 440, 1/2-inch.
      b. Homasote NCFR, 1/2-inch, for applications requiring fire ratings.
   5. Neoprene: 1/4-inch or 1/2-inch strips, stock lengths.
   6. Polyethylene Foam:
      a. Ethafoam: Semi-rigid white foam planks, 1-, 2-, or 4-inch thickness.
      b. Volara #940: 1/8-inch or 1/4-inch thickness.
   7. Brown Kraft paper.
   8. Non-abrasive glassine paper.
   9. Preservation tape: 3M Scotch brand, number 4811.
   10. Sealant: Removable acrylic sealant
   11. Accessories: Fasteners, nails, screws, bolts, anchors or other devices required to complete installation, stainless steel, sizes as required

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.

B. Survey of Existing Conditions: Allow time to record existing conditions prior to commencement of dismantling.

C. Dismantling Equipment: Use manual, hand-held tools, except as follows or otherwise approved by Architect on a case-by-case basis.

D. Before removal or dismantling of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

E. Perform surveys as the Work progresses to detect hazards resulting from historic treatment procedures.

3.02 PROTECTION, GENERAL

A. Prepare and submit a Historic Finishes protection plan prior to proceeding with work.

B. Ensure that supervisory personnel are on-site and on duty when historic treatment work begins and during its progress.

C. Protect persons, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from historic treatment procedures.
   1. Use only proven protection methods, appropriate to each area and surface being protected.
   2. Provide barricades, barriers, and temporary directional signage to exclude public from areas where historic treatment work is being performed.
   3. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of historic treatment work.
   4. Contain dust and debris generated by removal and dismantling work and prevent it from reaching the public or adjacent surfaces.
   5. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
   6. Protect floors and other surfaces along haul routes from damage, wear, and staining.
   7. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.

D. Temporary Protection of Historic Materials:
   1. Protect existing historic materials with temporary protections and construction. Do not deface or remove existing materials.
   2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Architect.

E. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

F. Utility and Communications Services:
   1. Notify Government, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by the historic treatment work before commencing operations.
   2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for the historic treatment work.

3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

3.03 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following.
   1. Comply with NFPA 241 requirements unless otherwise indicated.
   2. Remove and keep area free of combustibles including, rubbish, paper, waste, and chemicals, except to the degree necessary for the immediate work.
   3. If retaining option in subparagraph below, indicate smoking areas on Drawings. Verify compliance with Government's requirements and with ordinances of authorities having jurisdiction.
   4. Prohibit smoking by all persons within Project work and staging areas.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or highly combustible materials, including welding, torch-cutting, soldering, brazing, paint removal with heat, or other operations where open flames or implements utilizing high heat or combustible solvents and chemicals are anticipated:
   1. Obtain Government's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Government before each occurrence, indicating location of such work.
   2. As far as practical, restrict heat-generating equipment to shop areas or outside the building.
   3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
   4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
   5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
   6. Fire Watch: Before working with heat-generating equipment or highly combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B and NFPA 241.

C. Fire Extinguishers, Fire Blankets, and Rag Buckets: Maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire watch are trained in fire-extinguisher and blanket operation.

3.04 HISTORIC TREATMENT PROCEDURES, GENERAL

A. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.

B. Halt the process of deterioration and stabilize conditions unless otherwise indicated. Perform work as indicated on Drawings. Follow the procedures in subparagraphs below and procedures approved in historic treatment program:
   1. Retain as much original (historic) material as possible; repair and consolidate rather than replace.
   2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
   3. Use reversible processes wherever possible.
   4. Use traditional repair and replacement materials and techniques unless otherwise indicated.

5. Record existing work before each procedure (preconstruction) and progress during the work with digital preconstruction documentation photographs. Comply with requirements in Section 01 32 33 "Photographic Documentation."

C. Where missing features are indicated to be repaired or replaced, provide features whose designs are based on accurate duplications rather than on conjectural designs, subject to approval of Architect.

D. Where Work requires existing features to be removed or dismantled and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.

E. Identify new and replacement materials and features with permanent marks hidden in the completed work to distinguish them from original materials. Record a legend of identification marks and the locations of the items on record Drawings.

F. When cleaning, match samples of existing materials that have been cleaned and identified for acceptable cleaning levels. Avoid over-cleaning to prevent damage to existing materials during cleaning.

3.05 HISTORIC MATERIALS REMOVAL AND DISMANTLING

A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.

B. Perform work according to the historic treatment program and approved mockups.
   1. Provide supports or reinforcement for existing construction that becomes temporarily weakened by the work, until the work is completed.
   2. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
   3. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.

C. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.

D. Removing and Dismantling Items on or near Historic Surfaces:
   1. Use only dismantling tools and procedures within 12 inches of historic surface. Do not use pry bars. Protect historic surface from contact with or damage by tools.
   2. Unfasten items to be removed, in the opposite order from which they were installed.
   3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
   4. Dismantle anchorages.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.
   1. Other than code-required special testing and inspections.

E. Control of installation.

F. Mock-ups.

G. Testing and inspection.

H. Manufacturers' field services.

I. Defect Assessment.

1.02 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents, or for Owner's information.

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
   1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
   2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
   1. Submit report in duplicate within 30 days of observation to Architect for information.
   2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the contract documents.
   2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.03 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
   2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State of Arkansas.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Code-required Testing and Inspections: See Section 01 4533 - Structural Tests and Special Inspections.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:
   1. Laboratory: Authorized to operate in the State of Arkansas.
   2. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
   3. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Room Mock-ups: Construct room mock-ups as indicated on drawings. Coordinate installation of materials, products, and assemblies as required in specification sections; finish according to requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

F. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

G. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Make corrections as necessary until Architect's approval is issued.

H. Accepted mock-ups shall be a comparison standard for the remaining Work.

3.03 TESTING AND INSPECTION

A. See individual specification sections for testing required.

B. Code-required Testing and Inspections: See Section 01 4533 - Structural Tests and Special Inspections.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
   1. Provide incidental labor and facilities:
      a. To provide access to Work to be tested/inspected.
      b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
      c. To facilitate tests/inspections.
      d. To provide storage and curing of test samples.
   2. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.04 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.05 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 01 4533
STRUCTURAL TESTS AND SPECIAL INSPECTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Arkansas Special Inspections Guidelines (SEAoAR SI GL 03 - 01/01/2023) in accordance with 2021 Arkansas Fire Prevention Code (based on 2021 International Building Code).

1.02 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with other construction document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The Owner will engage one or more qualified Special Inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

D. Related Sections include but are not limited to the following:
   1. Section 03 3000 Cast-In-Place Concrete
   2. Section 05 1200 Structural Steel Framing
   3. Section 05 3100 Steel Decking
   4. Section 05 5000 Metal Fabrications and Miscellaneous Metals
   5. Section 06 1000 Rough Carpentry
   6. Section 06 1323 Heavy Timber Construction
   7. Section 06 1500 Wood Decking
   8. Section 06 1600 Sheathing
   9. Section 06 1753 Shop-Fabricated Wood Trusses
   10. Section 06 1800 Glued-Laminated Construction
   11. Section 31 1040 Micropiles

1.03 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings/Submittal Data: Written, graphic and pictorial documents prepared and/or assembled by the Contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or Special Inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The Special Inspector shall be a licensed Professional Engineer, Engineering Intern, or a qualified representative from the testing agency who is under supervision of a licensed Professional Engineer.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed Professional Engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and/or Inspection of Materials Used in Construction.
      a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
   2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.05 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The Special Inspector's reports and testing agencies results shall have precedence over reports and test results provided by the Contractor.

D. Where a conflict exists between the construction documents and approved shop drawings/submittal data, the construction documents shall govern unless the shop drawings/submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.06 SUBMITTALS BY SPECIAL INSPECTOR AND/OR TESTING AGENCY

A. Special Inspectors shall keep and distribute records of inspections. The Special Inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, Contractor, Architect, and Owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:
    a. Date of inspection.
    b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
    c. Statement noting that the work, material, and/or product conforms or does not conform to the construction document requirements.
        1) Name and signature of Contractor's representative who was notified of work, material, and/or products that do not meet the construction document requirements.
    d. Name and signature of Special Inspector and/or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection/test report and subsequent dates of re-inspection/retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 PRODUCTS (not used)

PART 3 EXECUTION

3.01 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall coordinate the inspection and testing services with the progress of the work. The Contractor shall provide sufficient notice to allow proper scheduling of all personnel. The Contractor shall provide safe access for performing inspection and on site testing.

B. The Contractor shall submit schedules to the Owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. Each Contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written Contractor's statement of responsibility to the building official and to the Owner prior to the commencement of work on the system or component. The Contractor's statement of responsibility shall contain the following:

1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
3. Procedures for exercising control within the Contractor's organization, the method and frequency of reporting and the distribution of the reports.

4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

D. Each Contractor responsible for the construction of a main wind force-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the Owner prior to the commencement of work on the system or component. The Contractor's statement of responsibility shall contain the following:
   1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
   2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
   3. Procedures for exercising control within the Contractor's organization, the method and frequency of reporting and the distribution of the reports.
   4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

E. The Contractor shall repair and/or replace work that does not meet the requirements of the construction documents.
   1. Contractor shall engage an Engineer/Architect to prepare repair and/or replacement procedures.
   2. Engineer/Architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and Owner.
   3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and Owner before proceeding with corrective action.

F. The Contractor shall be responsible for costs of:
   1. Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the construction documents and shop drawings/submittal data.
   2. Review of proposed repair and/or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
   3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.02 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.03 TESTING AND INSPECTION

A. Testing and inspection shall be in accordance with the attached Schedule of Special Inspections.

B. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

PART 4 SCHEDULES AND FORMS

A1 – Statement of Special Inspection

A2 – Statement of Special Inspections Requirements for Seismic Resistance

A3 - Statement of Special Inspections Requirements for Tornado Resistance

A4 – Final Report of Special Inspections

B1 to B15 – Schedule of Special Inspection Services

BC1 to BC5 – Commentary on Schedule of Special Inspection Services

C1 – Contractor's Statement of Responsibility

C2 – Fabricator's Certificate of Compliance

C3 – Nonstructural Components Certificate of Compliance

D1 – Special Inspection Report

D2 – Special Inspection Discrepancy Notice

E1 to E4 – Minimum Special Inspector Qualifications

END OF SECTION

STATEMENT OF SPECIAL INSPECTIONS

(Completed by the Registered Design Professional in Responsible Charge)

PROJECT: CENTRAL HOUSE & GARDEN

LOCATION: 606 E CENTRAL, BENTONVILLE, AR

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

_____

ARCHITECT OF RECORD: WER ARCHITECTS

STRUCTURAL ENGINEER OF RECORD: ENFRA

MECHANICAL ENGINEER OF RECORD: INSIGHT

ELECTRICAL ENGINEER OF RECORD: INSIGHT

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: WER ARCHITECTS

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2021 Arkansas Fire Prevention Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Requirements for Seismic Resistance* and/or *Requirements for Tornado Resistance*.

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? ◉ Yes ○ No

Are *Requirements for Tornado Resistance* included in the *Statement of Special Inspections*? ◉ Yes ○ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

☐ Weekly ☑ Bi-Weekly ☐ Monthly Other; specify:_____

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

Preparer's Seal

_____
Type or print name

_____
Signature Date

Building Official's Acceptance:

_____
Signature Date

Permit Number:

Frequency of interim report submittals to the Building Official:

☐ Monthly ☐ Bi- Monthly ☐ Upon Completion Other; specify:_____

Statement of Special Inspections
Requirements for Seismic Resistance

See the Schedule of Special Inspections for inspection and testing requirements.

Seismic Design Category: B

Statement of Special Inspection for Seismic Resistance Required (Yes/No): NO

Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:
(Required for Seismic Design Categories B, C, D, E or F in accordance with Building Code Section 1705.13.1 through 1705.13.3, and 1705.14.1). Some systems not required in SDC B, see section 1705.13.

NOT APPLICABLE

Description of designated seismic systems subject to special inspection, testing and qualification for seismic resistance:
(Required for architectural, electrical and mechanical systems and their components that require design in accordance with ASCE 7-16 Chapter 13, have a component importance factor, *Ip*, greater than one and are in Seismic Design Categories C, D, E or F, in accordance with Building Code Section 1705.13.4 and 1705.14.3.)

NOT APPLICABLE

Description of additional components and systems requiring special inspections, testing and qualification for seismic resistance:
(Required for systems noted in Building Code Sections 1705.13.5 through 1705.13.9 and 1705.14.2 1705.11).

NOT APPLICABLE

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must each submit a Statement of Responsibility (pg C1) in accordance with Building Code Section 1704.4.

Statement of Special Inspections
Requirements for Tornado Resistance

See the Schedule of Special Inspections for inspection and testing requirements

Design Wind Speed: 107 **m.p.h.**
(The tornado design wind speed is 250 miles per hour for the entire state of Arkansas per FEMA P-361 and ICC 500.)

Wind Exposure Category: C
(Wind Exposure Category C should be used to calculate wind pressures acting on community safe rooms and tornado shelters designed and constructed in accordance with FEMA P-361 and ICC 500.)

Statement of Special Inspection for Tornado Resistance Required (Yes/No): NO
(Required for community safe rooms and tornado shelters designed and constructed in accordance with FEMA P-361.)

Description of main wind force-resisting system subject to special inspection for wind resistance:
(Required for systems noted in Building Code Section 1705.12.1 and 1705.12.2)

NOT APPLICABLE

Description of wind force-resisting components subject to special inspection for wind resistance:
(Required for systems noted in Building Code Section 1705.12.3)

NOT APPLICABLE

Statement of Responsibility:
Each contractor responsible for the construction or fabrication of a system or component described above must each submit a Statement of Responsibility (pg C1) in accordance with Building Code Section 1704.4.

FINAL REPORT OF SPECIAL INSPECTIONS

(Completed by each Special Inspector)

PROJECT: _____

LOCATION: _____

PERMIT APPLICANT: _____

APPLICANT'S ADDRESS: _____

_____

ARCHITECT OF RECORD: _____

STRUCTURAL ENGINEER OF RECORD: _____

MECHANICAL ENGINEER OF RECORD: _____

ELECTRICAL ENGINEER OF RECORD: _____

REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE: _____

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents and approved design revisions.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered ___ to ___ form a basis for, and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated _____ have been corrected:

_____

_____

_____

_____

_____

(Attach 8 ½"x11" continuation sheet(s) if required to complete the description of corrections)

Prepared By:

_____

Special Inspection Agent/Firm

_____

Type or print name of Special Inspector

_____

Signature Date

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.1.1 Special Cases (work unusual in nature, including but not limited to alternative construction materials, unusual design applications, systems or materials with special manufacturer requirements. Attach 8 1/2x11 if needed).	Submittal review, shop(3) inspection and/or field inspection.	N			
1705.2 Structural Steel Construction					
1. Review the material test reports and certificates as listed in AISC 360-16, Section N3.2 for compliance with the construction documents	Submittal review	N	Each submittal		
2. Material verification of structural steel	Shop (3) and field inspection	N	Periodic		
3. Anchor Rods and other Embedment(s) (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	N	Continuous		
4. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	-	Periodic		
5. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)		
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)		
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	-	Observe or Perform as noted (4)		
d. Nondestructive testing (NDT) of welded joints: *see Commentary*		-			
1) Complete penetration groove welds at joints in materials 5/16" thick or greater in Risk Category III or IV	Shop (3) or field ultrasonic testing - 100%	N	Periodic		
2) Complete penetration groove welds at joints in materials 5/16" or greater in Risk Category II	Shop (3) or field ultrasonic testing - 10% of welds minimum	Y	Periodic		
3) Thermally cut surfaces of access holes when material t > 2"	Shop (3) or field magnetic Particle or Penetrant testing	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	N	Periodic		
5) Fabricator's NDT reports when fabricator performs NDT	Verify reports	N	Each submittal (5)		
6. Structural steel bolting:	Shop (3) and field inspection	-			
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360-16, Table N5.6-1)		N	Observe or Perform as noted (4)		
b.Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360-16, Table N5.6-2)		N	Observe (4)		
1) Pre-tensioned and slip-critical joints		-			
a) Turn-of-nut with matching markings		Y	Periodic		
b) Direct tension indicator		Y	Periodic		
c) Twist-off type tension control bolt		Y	Periodic		
d) Turn-of-nut without matching markings		N	Continuous		
e) Calibrated wrench			Continuous		
2) Snug-tight joints		-	Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		N	Perform (4)		
7. Inspection of steel elements of composite construction prior to concrete placement in accordance with SDI QA/QC tasks listed in Section 1705.2.2 for steel deck and AISC 360-16, Table N5.4-2 Section N5 for welding Headed stud anchors	Shop (3) and field inspection and testing	Y	Observe or Perform as noted (4)		
a. Placement and installation of steel headed stud anchors		Y	Periodic		
1705.2.2 Cold-formed Steel Deck (shall be performed according to the requirements of SDI QA/QC)					
1. Inspection or Execution Tasks Prior and After Deck Placement according to Table 1.1 & 1.2 of SDI QA/QC:		-			
a. Identification markings	Field inspection	Y	Periodic		
b. Manufacturer's certified test reports, deck profile and thickness	Submittal Review	N	Each submittal		
c. Verify deck installation per construction documents	Field inspection	Y	Periodic		
2. Inspection Prior, During & After Welding of Steel Deck according to Table 1.3, 1.4 & 1.5 of SDI QA/AC:		Y			

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
		APPLICABLE TO THIS PROJECT			
MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
a. Prior (Table1.3): Welding procedure Specifications (WPS) available, Manufacturer's certifications for welding consumables available, Material identification (type/grade), welding equipment check.	Field inspection	Y	Periodic		
b. During (Table 1.4): Qualified welders, Environmental Conditions, WPS followed	Field inspection	Y	Periodic		
c. After (Table 1.5): Verify size and location of welds, including support, sidelap, and perimeter welds	Field inspection	Y	Periodic		
d. After (Table 1.5): Welds meet visual acceptance criteria	Field inspection	Y	Periodic		
e. After (Table 1.5): Verify repair activities and Document acceptance or rejection of welds	Field inspection	Y	Periodic		
3. Inspection Prior, During & After Mechanical Fastening of Steel Deck according to Table 1.6, 1.7 & 1.8 of SDI QA/AC:		-			
a. Prior (Table1.6): Manufacturer installation instructions available for mechanical fasteners, Proper tools available for fastener installation, Proper storage for mechanical fasteners	Field inspection	Y	Periodic		
b. During (Table 1.7): Fasteners are positioned as required and fasteners are installed according to manufacturer's instructions	Field inspection	Y	Periodic		
c. After (Table 1.8): Check spacing, type, and installation of support, sidelap, and perimeter fasteners.	Field inspection	Y	Periodic		
d. After (Table 1.8): Verify repair activities and Document acceptance or rejection of mechanical fasteners	Field inspection	Y	Periodic		
1705.2.3 Open-web Steel Joist and Joist Girders (Table 1705.2.3)					
1. Installation of open-web steel joists and joist girders.		N			
a. End connections - welding or bolted	Field inspection	N	Periodic		
b. Bridging - horizontal or diagonal	Field inspection	N	Periodic		
1705.2.4 Cold-formed Steel Trusses spanning 60 feet or greater					
1. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package.	Field inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.3 Concrete Construction					
1. Inspection of reinforcement, including prestressing tendons, and verify placement. Placement includes reinforcing bar size, shape, spacing, cover, embedment, orientation, bar length, and splices per the construction documents and approved placement drawings.	Field inspection	Y	Periodic		
2. Reinforcing bar welding					
a. Verify weldability of reinforcing bars other than ASTM A706	Field inspection	N	Periodic		
b. Inspect single-pass fillet welds, maximum 5/16"	Field inspection	N	Periodic		
c. Inspect fillet welds >5/16" and other weld types	Field inspection	N	Continuous		
3. Inspection of anchors cast in concrete	Shop (3) and field inspection	Y	Periodic		
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete: Per research reports requirements	Field inspection	Y	Periodic or as required by the research report issued by an approved source		
a. Adhesive anchors installed horizontally or in upwardly inclined orientations to resist sustained tension loads.	Field inspection	N	Continuous		
b. Mechanical anchors and adhesive anchors not defined in 4.a.	Field inspection	N	Periodic		
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic		
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests and determine temperature of concrete	Shop (3) and field inspection	Y	Continuous		
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	N	Continuous		
8. Inspection for maintenance of specified curing temperature and techniques	Shop (3) and field inspection	N	Periodic		
9. Inspection of prestressed concrete:	In-plant or field review	N			
a. Application of prestressing forces		N	Continuous		
b. Grouting of bonded prestressing tendons in the seismic-force-resisting system		N	Continuous		
10. Inspect erection of precast concrete members	Field inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspection such connections and reinforcement for:		N			
a. Installation of the embedded parts	Field inspection	N	Continuous		
b. Completion of the continuity of reinforcement across joints	Field inspection	N	Continuous		
c. Completion of connections in the field.	Field inspection	N	Continuous		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5	Field inspection	N	Periodic		
13. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	Field testing and review of laboratory reports	N	Periodic		
14. Inspection of formwork for shape, lines, location and dimensions	Field inspection	N	Periodic		
15. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic		
16. For post-tensioned concrete, inspect cutting of tendon tail, installation of encapsulation cap and filling of stressing pocket in accordance with the construction documents and the post tensioning installation drawings.	Field inspection	N	Continuous		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.4 Masonry Construction					
(A) Level 1, 2 and 3 Quality Assurance:		N			
1. Prior to constructuction, verification of compliance of submittals	Submittal review	N	Periodic		
(B) Level 2 Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction	Testing by unit strength method or prism test method	N	Periodic		
(C) Level 3 Quality Assurance:					
1. Verification of f'_m and f'_{AAC} prior to construction and for every 5,000 SF during construction	Testing by unit strength method or prism test method	N	Periodic		
2. Verification of proportions of materials in premixed or preblended mortar, prestressing grout, and grout other than selfconsolidating grout, as delivered to the project site	Field inspection	N	Continuous		
(D) Levels 2 and 3 Quality Assurance:					
1. Verification of Slump Flow and Visual Stability Index (VSI) of selfconsolidating grout as delivered to the project	Field testing	N	Continuous		
2. Verify proportions of site-mixed mortar, grout and prestressing grout for bonded tendons	Field Inspection	N	Periodic		
3. Verify location, grade, type, and size of reinforcement and anchor bolts, and prestressing tendons and anchorages	Field Inspection	N	Periodic		
4. Verify prestressing technique	Field Inspection		Periodic		
5. Verify sample panel construction	Field Inspection	N	Periodic		
6. Verify placement of masonry units and mortar joint construction	Field Inspection	N	Periodic		
7. Verify placement of reinforcement, connectors, and prestressing tendons and anchorages	Field Inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
8. Verify grout space prior to grouting	Field Inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
9. Verify placement of grout and prestressing grout for bonded tendons	Field Inspection	N	Continuous		
10. Verify size and location of structural members	Field Inspection	N	Periodic		
11. Verify type, size, and location of anchors, including details of anchorage of masonry to structural members, frames, or other construction.	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
12. Verify welding of reinforcement (see 1705.3.1)	Field inspection	N	Continuous		
13. Verify preparation, construction, and protection of masonry during cold weather (temperature below 40° F) or hot weather (temperature above 90° F)	Field inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
14. Verify application and measurement of prestressing force	Field Inspection	N	Continuous		
15. Verify placement of AAC masonry units and construction of thin-bed mortar joints (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
16. Verify placement of AAC masonry units and construction of thin-bed mortar joints (after the first 5000 SF of AAC masonry)	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
17. Verify properties of thin-bed mortar for AAC masonry (first 5000 SF of AAC masonry)	Field inspection	N	Continuous		
18. Verify properties of thin-bed mortar for AAC masonry (after the first 5000 SF of AAC masonry)	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
19. Verify compliance of materials and procedures with the approved submittals	Field inspection	N	Periodic		
20. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	N	Level 2 - Periodic		
		N	Level 3 - Continuous		
1705.5 Wood Construction					
1. Inspection of the fabrication process of wood structural elements and assemblies in accordance with Section 1704.2.5	In-plant review (3)	Y	Periodic		
2. For high-load diaphragms, verification of grade and thickness of structural panel sheathing.	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agrees with approved construction documents.	Field inspection	N	Periodic		
4. Metal-plate-connected wood trusses with overall heights of 60 inches or greater inspection shall be performed to verify that the installation of the permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package.	Field Inspection	Y	Periodic		
5. Metal-plate-connected wood trusses with a clear span of 60 feet or greater, the special inspector shall verify during construction that the temporary installation restraint/bracing is installed in accordance with the approved truss submittal package.	Field inspection	N	Continuous		

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PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
6.Mass timber construction for elements in types IV-A, IV-B, and IV-C construction	Field inspection	N	Continuous		
a. Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	Field inspection	N	Periodic		
b. Inspect erection of mass timber construction	Field Inspection	N	Periodic		
c. Inspection of connections where installation methods are required to meet design loads.		N			
i. Threaded fasteners					
ia. Verify use of proper installation equipment	Field inspection	N	Periodic		
ib. verify use of pre-drilled holes where required	Field inspection	N	Periodic		
ic. Inspect screws, including diameter, length, head type, spacing, installation angle and depth	Field inspection	N	Periodic		
ii. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads	Field inspection	N	Continuous		
iii. Adhesive anchors not defined in preceding cell	Field inspection	N	Periodic		
iv. Bolted connections	Field inspection	N	Periodic		
v. Conceaed connections	Field inspection	N	Periodic		
1705.6 Soils					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic		
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic		
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic		
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities, and lift thicknesses during placement and compaction of compacted fill	Field inspection	N	Continuous		
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic		
1705.7 Driven Deep Foundations					
1. Verify element materials, sizes and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		

SCHEDULE OF SPECIAL INSPECTION SERVICES					
PROJECT	(Completed by the Registered Design Professional in Responsible Charge)				
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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with Statement of Special Inspections		
1705.8 Cast-in-Place Deep Foundations					
1.Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	Y	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	Y	Continuous		
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3	Y	See Section 1705.3		
1705.9 Helical Pile Foundations					
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required	Field inspection	N	Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
1705.11 Fabricated Items					
Inspection of fabricated items shall be performed in accordance with Section 1704.2.5		N			
1. List of fabricated items requiring special inspection during fabrication:	Shop Inspection	N			
2. List of fabricated items to be fabricated on the premesis of a fabricator approved to perform such work without special inspection:		N			

SCHEDULE OF SPECIAL INSPECTION SERVICES					
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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.12.1 Structural Wood Special Inspections For Wind (Tornado) Resistance					
1. Inspection of field gluing operations of elements of the main windforce-resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.12.2 Cold-formed Steel Special Inspections For Wind (Tornado) Resistance					
1.Inspection during welding operations of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
2.Inspections for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system	Shop (3) and field inspection	N	Periodic		
1705.12.3 Wind-resisting Components					
1. Roof covering, roof deck and roof framing connections	Shop (3) and field inspection	N	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.	Shop (3) and field inspection	N	Periodic		
1705.13.1 Structural Steel Special Inspections for Seismic Resistance					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 341-16,Section J2 for compliance with construction documents)	Submittal Review	N	Each submittal		
2. Structural steel welding:					
a. Inspection tasks Prior to, During and After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 341-16, Table J6.1, J6.2 & J6.3)	Shop (3) and field inspection	N	Observe or Perform as noted (4)		
b. Nondestructive testing (NDT) of welded joints in accordance with AISC 341-16, Section J6.2.	Shop (3) and field testing	N	Periodic		
3. Structural steel bolting:					
a. Inspection tasks Prior to, During and After Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 341-16, Table J7.1, J7.2 & J7.3)	Shop (3) and field inspection	N	Observe or Perform as noted (4)		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
4. Other Steel Structure Inspections, in accordance with QA tasks listed in AISC 341-16, Table J8.1:		N			
a. RBS requirements	Shop (3) and field inspection	N	Observe (4)		
b. Protected zones	Shop (3) and field inspection	N	Observe (4)		
5. Composite construction:					
a. Inspection tasks Prior to, During and After Concrete Placement (Observe, or perform tasks, in accordance with QA tasks listed in AISC 341-16, Table J9.1, J9.2 & J9.3)	Field inspection	N	Observe (4)		
6. H-Piling:					
a. Inspection of H-piling in accordance with AISC 341-16, Table J10.1	Field Inpsection	N	Periodic		
1705.13.2 Structural Wood Special Inspections for Seismic Resistance					
1. Inspection of field gluing operations of elements of the seismic-force resisting system	Field inspection	N	Continuous		
2. Inspection of nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system	Shop (3) and field inspection	N	Periodic		
1705.13.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance					
1. Inspection during welding operations of elements of the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the seismic force-resisting system	Shop (3) and field inspection	N	Periodic		
1705.13.4 Designated Seismic System Verification					
Inspect and verify that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with 13.2.2 of ASCE 7-16	Field inspection	N	Periodic		
1. Architectural Designated Seismic Systems (per ASCE 7-16)					
a. Interior non-structural partition walls and connections	Field Inspection	N	Periodic		
b. Parapets	Field Inspection	N	Periodic		
c. Chimneys	Field Inspection	N	Periodic		
d. Exterior non-structural walls elements and connections	Field Inspection	N	Periodic		
e. Veneer	Field Inspection	-	Periodic		
f. Suspended Ceiling Systems	Field Inspection	N	Periodic		
g. Cabinets	Field Inspection	N	Periodic		
h. Storefront and curtainwall framing	Field Inspection	N	Periodic		
i. Access Floors	Field Inspections	N	Periodic		
j. Glass in glazed interior and exterior storefront and curtainwall systems	Field Inspection	N	Periodic		
k. Laboratory Equipment	Field Inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
2. Mechanical & Electrical Designated Seismic Systems (per ASCE 7-16)		N			
a. Mechanical and Electrical Components		N			
1) Air-side HVAC fans, air handlers, air conditioning units, cabinet heaters, air distribution boxes, and other mechanical components constructed of sheet metal framing	Field Inspection	N	Periodic		
2) Wet side HVAC, boilers, furnaces, atmospheric tanks and bins, chillers, water heaters, heat exchangers, evaporators, air separators, manufacturing or process equipment and other mechanical components constructed of high-deformability materials	Field Inspection	N	Periodic		
3) Engines, turbines, pumps, compressors, and pressure vessels	Field Inspection	N	Periodic		
4) Elevator and escalator components	Field Inspection	N	Periodic		
5) Generators, batteries, invertors, motors, transformers, and other electrical components constructed of high deformability materials	Field Inspection	N	Periodic		
6) Motor control centers, panel boards, switch gear, instrumentation cabinets, and other components constructed of sheet metal framing	Field Inspection	N	Periodic		
7) Communication equipment, computers, instrumentation and controls	Field Inspection	N	Periodic		
8) Roof mounted stacks, cooling and electical towers	Field Inspection	N	Periodic		
9) Light fixtures	Field Inspection	N	Periodic		
b. Vibration Isolated Components & Systems					
1) Components and systems isolated using neoprene elements and neoprene isolated floors with built-in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection	N	Periodic		
2) Spring isolated components and systems closely restrained using built in or separate elastomeric snubbing devices or resilient perimeter stops	Field Inspection	N	Periodic		
3) Internally isolated systems and supports	Field Inspection	N	Periodic		
4) Suspended vibration isolation equipment including in-line duct devices and suspended internally isolated components	Field Inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
c. Distribution Systems					
1) Piping and tubing including in-line components	Field Inspection	N	Periodic		
2) Ductwork, including in–line components	Field Inspection	N	Periodic		
3) Electrical conduit and cable trays	Field Inspection	N	Periodic		
4) Bus ducts		N			
5) Plumbing	Field Inspection	N	Periodic		
6) Pneumatic tube transport systems	Field Inspection	N	Periodic		
7) Fire Protection Sprinkler Pipe System	Field Inspection	N	Periodic		
1705.13.5 Architectural Components Special Inspections for Seismic Resistance					
1. Inspection during the erection and fastening of exterior cladding and interior and exterior veneer.	Field inspection	N	Periodic		
2. Inspection during the erection and fastening of interior and exterior non load bearing walls.	Field inspection	N	Periodic		
3. Inspection during anchorage of access floors	Field inspection	N	Periodic		
1705.13.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems.	Field inspection	N	Periodic		
2. Inspection during the anchorage of other electrical equipment.	Field inspection	N	Periodic		
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units	Field inspection	N	Periodic		
4. Inspection during the installation and anchorage of ductwork designed to carry hazardous materials	Field inspection	N	Periodic		
5. Inspection during the installation and anchorage of vibration isolation systems.	Field inspection	N	Periodic		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
6. Inspection during the installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed to verify on of the following:		N			
a. Minimum clearances have been provided as required by Section 13.2.3 ASCE 7	Field inspection	N	Periodic		
b. A nominal clearance of not less than 3 inches has been provided between fire protection sprinkler system drops and sprigs and; structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems piping	Field inspection	N	Periodic		
1705.13.7 Storage Racks for Seismic Resistance					
Steel storage racks 8 feet or greater in height		N			
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents	Field inspection	N	Periodic		
2. Fabricated storage rack elements.	Field inspection	N	Periodic		
3. Storage rack anchorage installation.	Field inspection	N	Periodic		
4. Completed storage rack system, to indicate compliance with the approved construction documents	Field inspection	N	Periodic		
1705.13.9 Cold-formed Steel Special Bolted Moment Frames					
Inspection during the installation of cold-formed steel special bolted moment frames	Shop and field inspection	N	Periodic		
1705.14.1 Structural Steel Testing and Qualification for Seismic Resistance					
Test structural steel in the seismic force-resisting system in accordance with the quality assurance requirements of AISC 341	Shop (3) and field testing	N	Per AISC 341		

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MATERIAL / ACTIVITY	**SERVICE**	**Y/N**	**EXTENT**	**AGENT***	**DATE COMPLETED**
1705.14.2 Seismic Certification of Nonstructural Components					
Review certificate of compliance for designated seismic system components.	Certificate of compliance review	N	Each submittal		
1705.14.4 Seismic Isolation Systems					
Test seismic isolation system in accordance with ASCE 7 Section 17.8	Prototype testing	N	Per ASCE 7		
1705.15 Sprayed Fire-resistant Materials					
1. Verify surface condition preparation of structural members.	Field inspection	N	Periodic		
2. Verify application of sprayed fire-resistant materials.	Field inspection	N	Periodic		
3. Verify average thickness of sprayed fire-resistant materials applied to structural members.	Field inspection	N	Periodic		
4. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design.	Field inspection and testing	N	Per Building Code section 1705.15.5		
5. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material.	Field inspection and testing	N	Per Building Code section 1705.15.6		
1705.16 Mastic and Intumescent Fire-Resistant Coatings					
Inspect mastic and intumescent fire-resistant coatings applied to structural elements and decks, in accordance with AWCI 12-B.	Field inspection	N	Periodic		
1705.17 Exterior Insulation and Finish Systems (EIFS)					
1. Verify materials, details and installations are per the approved construction documents	Field inspection	N	Periodic		
2. Inspection of water-resistive barrier coating over sheathing substrate	Field inspection	N	Periodic		
1705.18 Fire-Resistant Penetrations and Joints					
1. Inspect penetration firestop	Field testing	N	Per ASTM E 2174		
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E 2393		
1705.19 Smoke Control Systems					
1. Leakage testing and recording of device locations prior to concealment.	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification.	Field testing	N	Periodic		

SCHEDULE OF SPECIAL INSPECTION SERVICES

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MATERIAL / ACTIVITY	SERVICE	Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.20 Sealing of mass timber					
1. Inspect sealants or adhesive application where required by Section 703.7	Field testing	-	Periodic		

* INSPECTION AGENTS	FIRM	ADDRESS	TELEPHONE NO.
1.			
2.			
3.			
4.			
5.			

Notes: 1. The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent, not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies are subject to the approval of the Building Official and/or the Design Professional.

2. The list of Special Inspectors may be submitted as a separate document, if noted so above.

3. Special Inspections as required by Section 1704.2.5 are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1

4. Observe on a random basis, operations need not be delayed pending these inspections. Perform these tasks for each welded joint, bolted connection, or steel element.

5. NDT of welds completed in an approved fabricator's shop may be performed by that fabricator when approved by the AHJ. Refer to AISC 360, N7.

Circle "Yes" or "No" as appropriate and date this document below:

Are *Requirements for Seismic Resistance* included in the *Statement of Special Inspections*? (Yes) **No**

Are *Requirements for Tornado Resistance* included in the *Statement of Special Inspections*? (Yes) **No**

DATE:

COMMENTARY ON SCHEDULE OF SPECIAL INSPECTION SERVICES	
MATERIAL / ACTIVITY	**COMMENTARY**
General	Other items may be added to the Schedule of Special Inspection Services at the discretion of the Design Professional and/or the Owner.
Definition: Special Inspection	Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with this code and the approved construction documents.
Definition: Special Inspector	A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.
Definition: Continuous Special Inspection	Special inspection by the special inspector who is present when and where the work to be inspected is being performed.
Definition: Periodic Special Inspection	Special inspection by the special inspector who is intermittently present where the work to be inspected has been or is being performed.
1704.2.5 Inspection of Fabricators	Required where structural load-bearing members are fabricated in a shop, except not required where fabricator is approved in accordance with section 1704.2.5.2. Where this exception is utilized, at the completion of fabrication, the fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.
1705.2 Steel Construction	
5.d. Non destructive testing (NDT) of welded joints	As a minimum for special inspections, AISC 360 Chapter N requires UT testing of complete joint penetration groove welds (CJP) subject to transversely applied tension loading in butt, T- and corner joints, in materials 5/16" (8mm) thick or greater. Further NDT testing, including UT testing of partial penetration groove welds (PJP) and magnetic particle or penetrant testing of fillet welds, may be added at the option of the engineer of record as a project requirement. AISC 360 Chapter N also allows reduction or increase in the rate of UT testing if approved by the engineer of record and by the authority having jurisdiction.
5.d. 3), Non destructive testing of thermally cut surfaces of access holes.	This requirement is intended to apply when the flange thickness of rolled shapes exceeds 2" or when the web thickness of built up shapes exceeds 2". Any crack shall be deemed unacceptable regardless of size or location.
5.d. 5), Review of fabricator's NDT reports.	NDT of welds completed in an approved fabricator's shop may be performed by that fabricator only when approved by the authority having jurisdiction. Special Inspections include review of reports of all NDT testing done by the fabricator.
1705.2.2 Cold-formed Steel Deck	(shall be perform according to the requirements of SDI QA/QC)
2.a. Floor and roof cold-formed steel deck welds.	Field welding of deck in accordance with AWS D1.3, SDI C, SDI NC, and SDI RD.
3 Floor and roof cold-formed steel deck mechanical Fasteners.	Installation of mechanical fasteners in accordance with SDI C, SDI NC, SDI RD, and manufacturer's instructions.
1705.3 Concrete Construction	Special Inspections are not required for certain isolated spread concrete footings, certain continuous concrete footings, nonstructural concrete slabs supported directly on the ground, and concrete foundation walls constructed in accordance with Table 1807.1.6.2. See Section 1705.3 for these specific exceptions. Special inspections are not required for any concrete patios, driveways and sidewalks, on grade.

COMMENTARY ON SCHEDULE OF SPECIAL INSPECTION SERVICES	
MATERIAL / ACTIVITY	**COMMENTARY**
10. Erection of precast concrete members.	Inspection of the erection of precast concrete has always been included in IBC, but no specific inspections have been indicated. Inspection of bolts and welds for precast concrete are covered in Section 1705.2 Steel Construction. Any specific precast erection inspection requirements should either be added to the project Special Inspection Schedule or Construction Documents. The following are some inspections that the Design Professional should consider: a. Verify member locations and joint details comply with construction and erection documents b. Verify proper bearing pad type and placement c. Verify placement of grout (including hot and cold weather procedures and that maximum specified number of levels to be placed before grouting are not exceeded) d. Verify joint widths are within specified tolerance where joints are to receive sealant e. Verify thread engagement and torque for mechanical connections
1705.4 Masonry Construction	Masonry construction shall be inspected and verified in accordance with TMS 402 and TMS 602 quality assurance program requirements. Exceptions: See 1705.4 Risk Categories: See 1604.5
Level 1 Quality Assurance	Masonry in Risk Category I, II, or III structures and designed in accordance with TMS 402 Part 4 (Prescriptive) or Appendix A (Emperical)
Level 2 Quality Assurance	1. Masonry in Risk Category IV structures and designed in accordance with TMS 402 Part 4 (Presecriptive) 2. Masonry in Risk Category I, II, or III structures and designed in accordance with TMS 402 Part 3, Appendix B or C (Engineered)
Level 3 Quality Assurance	Masonry in Risk Category IV structures and designed in accordance with TMS 402 Part 3, Appendix B or C (Engineered)
1705.5 Wood Construction	Special inspections of the fabrication process of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704.2.5. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. Exception: Special inspections are not required for portions of structures designed and constructed in accordance with IBC Section 2308 unless the approved construction documents indicate otherwise.

COMMENTARY ON SCHEDULE OF SPECIAL INSPECTION SERVICES	
MATERIAL / ACTIVITY	**COMMENTARY**
1705.6 Soils	The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance. Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D 1557.
1705.7 Driven Deep Foundations	The approved geotechnical report, and the construction documents prepared by the registered design professionals, shall be used to determine compliance.
1705.8 Cast-in-Place Deep Foundations	The approved geotechnical report, and the construction documents prepared by the registered design professionals, shall be used to determine compliance.
1705.9 Helical Pile Foundations	The approved geotechnical report, and the construction documents prepared by the registered design professional, shall be used to determine compliance.
1705.11 Fabricated Items	Special inspections of the fabricated items shall be performed during fabrication, except where the fabricator has been approved to perform work without special inspections in accordance with Section 1704.2.5.1.
1705.12 Special Inspections for Wind (Tornado) Resistance	Special inspection for Wind Resistance per IBC is typically only required in coastal areas subject to huricanne winds. In Arkansas, these design wind speeds (V_{asd} > 110 mph) would only be applicable to tornado resistant design.
1705.13.1 Structural Steel Special Inspections for Seismic Resistance	Mandatory in accordance with AISC 341 for the seismic force-resisting systems in Seismic Design Category B, C, D, E or F. Exceptions: 1. Structures assigned to Seismic Design Category B or C with structural steel systems not specifically detailed for seismic resistance with a Response Modification Coefficient, R, of 3 or less, excluding cantilever column systems.
1705.13.2 Structural Wood Special Inspections for Seismic Resistance	Mandatory for the seismic force-resisting systems in Seismic Design Category C, D, E or F. Exceptions: 1. Special inspection is not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other components of the seismic force-resisting system, where the lateral resistance is provided by structural sheathing, and the specified fastener spacing at the panel edges is more than 4 inches on center.

COMMENTARY ON SCHEDULE OF SPECIAL INSPECTION SERVICES	
MATERIAL / ACTIVITY	**COMMENTARY**
1705.13.3 Cold-formed Steel Light-Frame Special Inspections for Seismic Resistance	Mandatory for the seismic-force-resisting systems in Seismic Design Category C, D, E or F. Exceptions: 1. Sheathing is gypsum board or fiberboard. 2. Sheathing is wood structural panel or steel sheet on only one side and the fastener spacing of the sheathing is more than 4 inches on center.
1705.13.4 Designated Seismic Systems Verification	Definition, Designed Seismic Systems: Those nonstructural components that require design in accordance with ASCE 7 Chapter 13 and for which the component importance factor, Ip, is greater than 1 in accordance with ASCE 7 Section 13.1.3. The Schedule of Special Inspections lists all of the nonstructural components described in ASCE Chapter 13. Only those components that are Designated Seismic Systems require Speical Inspections.
Inspect and verify that that the component label, and anchorage or mounting conforms to the certificate of compliance in accordance with 1705.14.3.	Mandatory for Designated Seismic System components in structures assigned to Seismic Design Category C, D, E or F.
1705.13.5 Architectural Components Special Inspections for Seismic Resistance	
1. Inspection during the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer.	Mandatory for structures assigned to Seismic Design Category D, E or F. Exceptions: 1. Not required for exterior cladding, interior and exterior nonbearing walls, and interior and exterior veneer 30 feet or less in height above grade or walking surface. 2. Not required for exterior cladding and interior and exterior veneers weighing 5 psf or less. 3. Not required for interior nonbearing walls weighing 15 psf or less.
2. Inspection during anchorage of access floors.	Mandatory for structures assigned to Seismic Design Category D, E or F.
1705.13.6 Plumbing, Mechanical and Electrical Components Special Inspections for Seismic Resistance	
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems.	Mandatory for buildings assigned to Seismic Design Category C, D, E or F.
2. Inspection during the anchorage of other electrical equipment	Mandatory for buildings assigned to Seismic Design Category E or F.
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units.	Mandatory for buildings assigned to Seismic Design Category C, D, E or F.
4. Inspection during the installation and anchorage of ductwork designed to carry hazardous materials.	
5. Inspection during the installation and anchorage of vibration isolation systems.	Mandatory for structures assigned to Seismic Design Category C, D, E or F, where the construction documents require a nominal clearance of 0.25 inches or less, between the equipment support frame and restraint.

COMMENTARY ON SCHEDULE OF SPECIAL INSPECTION SERVICES	
MATERIAL / ACTIVITY	**COMMENTARY**
6. Inspection during the installation of mechanical and electical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed to verify minimal clearances	Mandatory for buildings assigned to Seismic Design Category C, D, E or F where automatic fire sprinklers systems are installed.
1705.13.7 Storage Racks Special Inspections for Seismic Resistance	Mandatory for buildings assigned to Seismic Design Category D, E or F.
1705.13.8 Seismic Isolation Systems	Mandatory for all Seismically Isolated Structures. See ASCE 7 Section 17 for additional inspection and quality control requirements.
1705.13.9 Cold-formed steel special bolted moment frames	Mandatory for buildings assigned to Seismic Design Category D, E or F.
1705.14 Testing for Seismic Resistance	
1705.14.1 Structural Steel Testing and Qualification for Seismic Resistance	Mandatory in accordance with AISC 341 for the seismic force-resisting systems in Seismic Design Category B, C, D, E or F. Exceptions: 1. Structures assigned to Seismic Design Category B or C with structural steel systems not specifically detailed for seismic resistance with a Response Modification Coefficient, R, of 3 or less, excluding cantilever column systems.
1705.14.2 Seismic Certification of Nonstructural Components	Applies to architectural, mechanical and electrical components in structures assigned to Seismic Design Category B, C, D, E or F and where the requirements of ASCE 7 Section 13.2.1 are met by submittal of manufacturer's certification, in accordance with Item 2.
Review certificate of compliance.	Review the construction documents for the requirements for certification by analysis, testing or experience data for nonstructural components and designated seismic systems in accordance with ASCE 7 Section 13.2.
1705.14.4 Seismic Isolation Systems	Mandatory for all Seismically Isolated Structures. Test in accordance with ASCE 7 Section 17.8.
1705.15 Sprayed Fire-resistant Materials	Special inspection shall be based on the fire-resistance design as designated in a approved construction documents. See Section 1705.14 for specific inspection and testing requirements.
1705.16 Mastic and Intumescent Fire-Resistant Coatings	Special inspection shall be based on the fire-resistance design as designated in a approved construction documents and in accordance with the Association of the Wall and Ceiling Industry Technical Manual AWCI 12-B.
1705.17 Exterior Insulation and Finish Systems (EIFS)	Mandatory except for applications installed over masonry or concrete walls, or where installed over a water-resistive barrier with means of draining moisture to the exterior. Special inspection is required for the water-resistive barrier coating if installed over sheathing substrate.
1705.18 Fire-Resistant Penetrations and Joints	Mandatory in high-rise buildings or in buildings assigned to Risk Category III or IV.
1705.19 Smoke Control Systems	Mandatory by special inspection agencies having expertise in fire protection engineering, mechanical engineering and certification as air balancers.

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic-resisting component listed in the Statement of Special Inspections (Requirements for Seismic or Tornado Resistance) must submit a Statement of Responsibility, in accordance with the Building Code, Section 1704.4.

Project:_____

Contractor's Name:_____

Address:_____

License No.:_____

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

_____
_____
_____
_____
_____
_____
_____

Contractor's Acknowledgement of Special Requirements

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to achieve conformance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Contractor's Provisions for Quality Control

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

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

Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the Building Code must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project: _____

Fabricator's Name: _____

Address: _____

Certification or Approval Agency: _____

Certification Number: _____

Date of Last Audit or Approval: _____

Description of structural members and assemblies that have been fabricated:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

Nonstructural Components Certificate of Compliance

For structures assigned to Seismic Category B, C, D, E, or F where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified by Item 2 described therein and as specified by the registered design professional.

Project:_____

Address:_____

Seismic Design Category:_____

Nonstructural Component:_____

Qualification Method: (Check all that apply)

a. Analysis: ☐

b. Testing: ☐

c. Experience Data: ☐

Description of nonstructural component:

_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that the items described above meet the requirements specified by the registered design professional on the approved construction documents for seismic qualification as per Section 1704.5 of the Building Code
.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of qualification method, building code evaluation service report or any other pertinent information.

Certificate of Compliance for Designated Seismic Systems

For structures assigned to Seismic Category C, D, E, or F and with designated seismic systems on the approved construction documents subject to the requirements of Section 13.2.2 of ASCE 7 whose requirements for certification are met by analysis, testing or experience data.

Project:_____

Address:_____

Seismic Design Category:_____

Designated Seismic System:_____

Certification Method: (Check all that apply)

a. Analysis: ☐

b. Testing: ☐

c. Experience Data: ☐

Description of Designated Seismic System:

_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that the designated seismic system as described above meets the requirements specified on the approved construction documents as per Section 1704.5 of the Building Code
.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach documentation pertaining to certification method, building code evaluation service report or any other pertinent information.

Preconstruction Tests for Shotcrete

For preconstruction tests required by ACI 318-19 of the Building Code, certify that a shotcrete test panel has been shot, examined & tested as meeting the requirements of ACI 318-19. Report of preconstruction test shall be submitted as specified in Section 1704.5 to the building official prior to commencement of the project.

Project: _____

Fabricator's Name: _____

Address: _____

Certification or Approval Agency: _____

Certification Number: _____

Date of Last Audit or Approval: _____

Description of test panel (as necessary):

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that the test panel described above were tested prior to commencement of the project in strict accordance with ACI 318-19 and the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification of test results or building code evaluation service report and fabricator's quality control manual.

Steel Joist Fabricator's Certificate of Compliance

The steel joist fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the Building Code must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project: _____

Fabricator's Name: _____

Address: _____

Certification or Approval Agency: _____

Certification Number: _____

Date of Last Audit or Approval: _____

Description of structural members and assemblies that have been fabricated:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents and the current edition of the Steel Joist Institute (SJI) specifications as listed in Section 2207.5 of the Building Code
.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

Certificate of Compliance of Material Properties for Weldability of Reinforcement with a Standard Other than ASTM A706

Submit reports of material properties verifying compliance with requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318-19 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded. Report shall be submitted as specified in Building Code Section 1704.5 to the building official.

Project:_____

Fabricator's Name:_____

Address:_____

Certification or Approval Agency:_____

Certification Number:_____

Date of Last Audit or Approval:_____

Description of material properties (as necessary):

I hereby certify that the material properties are in compliance as described above in strict accordance with AWS D1.4 and Section 1704.5 and the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of fabricator's certification of material properties or building code evaluation service report and fabricator's quality control manual.

Certificate of Compliance for Reports of Mill Tests for A615 Reinforcement Used in Seismic Force-Resisting Systems

Submit reports of mill tests in accordance with Section 20.2.2.5 of ACI 318-19 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E or F. Report shall be submitted as specified in Building Code Section 1704.5 to the building official.

Project: _____

Address: _____

Seismic Design Category: _____

Supplier's Name: _____

Supplier's Address: _____

Concrete Member Types & Location within Structure (as applicable):
Special Moment Frames:

_____

_____

Special Structural Walls:

_____

_____

Coupling Beams:

_____

_____

Other:

_____

_____

I hereby certify that the mill reports are in compliance as described above in strict accordance with Section 1704.5 and the approved construction documents.

_____
Name and Title (type or print)

_____ _____
Signature Date

Attach copies of supplier's mill test reports together with any other pertinent information.

SPECIAL INSPECTION REPORT

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:	
DATE OF INSPECTION:	
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC TIME BEGINNING INSPECTION: TIME ENDING INSPECTION:	
DESCRIBE INSPECTIONS MADE, INCLUDING LOCATIONS:	
LIST TESTS MADE:	
LIST ITEMS REQUIRING CORRECTIONS, CORRECTIONS OF PREVIOUSLY LISTED ITEMS AND PREVIOUSLY LISTED UNCORRECTED ITEMS: PROVIDE COPIES OF DISCREPANCY NOTICES:	
COMMENTS:	
TO THE BEST OF MY KNOWLEDGE, WORK INSPECTED WAS IN ACCORDANCE WITH THE APPROVED DESIGN DRAWINGS, AND SPECIFICATIONS, EXCEPT AS NOTED ABOVE.	
PRINTED FULL NAME	
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY	
SIGNED:	DATE:
CERTIFICATION:	NUMBER:

One copy of this report to remain at job site with the contractor for review upon request.

DISCREPANCY NOTICE No. _____

SPECIAL INSPECTION DISCREPANCY NOTICE

(Completed by Special Inspector)

PROJECT NAME / ADDRESS:		
INSPECTION TYPE(S) COVERAGE ☐ CONTINUOUS ☐ PERIODIC		
AREA INSPECTED	TYPE OF INSPECTION	
APPLICABLE DRAWING SHEET NUMBER(S) AND/OR SPECIFICATION SECTION:		
NOTICE DELIVERED TO: O CONTRACTOR O ENGINEER/ARCHITECT O OWNER	DATE:	TIME:
MAKE THE FOLLOWING CORRECTIONS AND SECURE INSPECTION APPROVAL PRIOR TO PROCEEDING WITH THIS PHASE OF THE WORK.		
PRINTED FULL NAME		
NOTE BY "SPECIAL INSPECTOR" OR PROVIDE NAME OF TESTING AGENCY		
SIGNED:	DATE:	
CERTIFICATION:	NUMBER:	
DATE RE-INSPECTED AND APPROVED AND SIGNATURE OF SPECIAL INSPECTOR:		

One copy of this report to remain at job site with the contractor for review upon request.

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1704.2.5 Inspection of Fabricators				
Pre-cast concrete	A, C, E			
Structural steel construction	C, F, G			
Wood construction	A, N			
Cold formed metal construction	A, N			
1705.2 Steel Construction				
Welding	C, F, G	C, F, G	A	A
High strength bolting, inspection of steel frame joint details		A, C	A	A
1705.2.2, 1705.2.3 and 1705.2.4 Steel Construction other than Structural Steel				
Welding	C, F, G	C, F, G	A	A
Cold-formed Steel Deck		C, F, G	A	A
Open-Web Steel Joist and Joist Girders		C, F, G	A	A
Cold-formed Steel Trusses spanning ≥ 60ft		A, C	A	A
1705.3 Concrete Construction				
Reinforcing placement, cast-in-place bolts, concrete and shotcrete placement and curing operations		A, C, H		
Pre-stressing steel installation		A, C, D, E		
Erection of pre-cast concrete members		A, C, H, Q		
Concrete field testing		A, C, H, I, J		
Review certified mill reports and design mixes			A	
Verify use of required design mix		A, C, H, I, J		
Pre-stressed (pre-tensioned) concrete force application	A, C, E			
Post-tensioned concrete force application		A, C, D, H		
Review of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs		A, C, D		
Reinforcing steel weldability, reinforcing welding, weld filler material		C, F, G		
Inspection of post-installed anchors in hardened concrete		A, C, S		
1705.4 Masonry				
Review f'_m prior to construction			A	
Mortar joint construction, grout protection and placement, materials proportion, type/size/location of reinforcement, structural elements, anchorage, and connectors		A, C		
Sampling/testing of grout/mortar specimens		A, C, K		
Observe preparation of masonry prisms for testing of compressive strength of masonry, f'_m		A, C, K		
Inspection of welding of reinforcing steel		C, F, G		
1705.5 Wood Construction				
Observe structural panel sheathing, size of framing members, fastener diameter and length, number of fastener lines, and spacing of fastener lines and fasteners for compliance with approved construction documents for the project		A, N		
Metal-plate-connected wood trusses: verify temporary and permanent truss bracing is installed per approved truss submittal package		A, N		

(Table continued on next page)

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1705.6 Soils				
Observe site preparation, fill placement and testing of compaction for compliance with the construction documents for the project		A, C, I, R		
Observe and test bearing materials below shallow foundations for ability to achieve design bearing capacity		A, L		
Review compaction testing for compliance with the construction documents for the project				A
1705.7, 1705.8 & 1705.9, 1705.10 Driven Deep, Cast-in-place Deep, and Helical Pile Foundations				
Observe installation		A, L, I		
Observe load tests		A, I		
1705.12 Special Inspection for Wind Resistance				
Structural wood		A, N		
Cold-Formed steel light-frame construction		A, N		
Inspect roof cladding		A, B, N		
Inspect wall cladding		A, B, N		
1705.13 Special Inspection for Seismic Resistance				
1705.13.1 Structural Steel				
Inspection of structural steel in the seismic force-resisting systems		A, C		
1705.13.2 Structural Wood				
Inspection of structural wood in the seismic force-resisting systems		A, N		
1705.13.3 Cold-Formed Steel Light-Frame Construction				
Inspection of cold-formed steel light-frame construction in the seismic force-resisting systems		A, N		
1705.13.4 Designated Seismic Systems				
Examine designated seismic systems requiring seismic qualification and verify that the label, anchorage or mounting conform to the certificate of compliance		A	A	A
1705.13.5 Architectural Components				
Inspection of exterior cladding, non-load bearing walls, veneer, and access floors		A, B	A, B	A, B
1705.13.6 Plumbing, Mechanical and Electrical Components				
Inspection of installation and anchorage of mechanical and electrical components		A	A	A
1705.13.7 Storage Racks				
Inspection of anchorage of storage racks 8 feet or taller		A		
1705.13.8 Seismic Isolation Systems				
Inspection of seismic isolation systems in seismically isolated structures	A	A		
1705.13.9 Cold-Formed Steel Special Bolted Moment Frames				
Inspection of cold-formed steel special bolted moment frames		A, N		
1705.14 Testing for Seismic Resistance				
Testing designated seismic systems requiring seismic qualification and verify that the label, anchorage or mounting conform to the certificate of compliance		A		
1705.15 Sprayed Fire-Resistant Materials				
Observe surface conditions, application, average thickness and density of applied material, and cohesive/adhesive bond		A, C		

(Table continued on next page)

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*				
Category of Testing and Inspection	**Minimum Qualifications (refer to key at end of Table)**			
	Shop Inspection	**Field Testing /Inspection**	**Review Submittals**	**Review Testing, Certification, & Lab Reports**
1705.16 Mastic and intumescent fire-resistant coatings				
Observe application compliance with AWCI 12-B		A, C		
1705.17 Exterior Insulation and Finish Systems				
Inspect EIFS systems		A, B, C, M		
1705.18 Fire-resistant penetrations and joints				
Inspection of Penetration firestops		A, C, P		
Inspection of Fire-resistant joint systems		A, C, P		
1705.19 Testing for Smoke Control	*See Requirements of Building Code Section 1705.19.2.*			
1705.20 Sealing of Mass Timber		A, C, P		
(Table continued on next page)				

MINIMUM SPECIAL INSPECTOR QUALIFICATIONS *(continued)*

KEY:

A. Arkansas Professional Engineer (AR PE) competent in the specific task area or graduate of accredited engineering/engineering technology program under the direct supervision of an AR PE.
B. Arkansas Registered Architect (AR RA) competent in the specific task area or graduate of accredited architecture/architecture technology program under the direction of an AR RA.
C. International Code Council (ICC) Special Inspector Certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
D. Post-tensioning Institute (PTI) Certification, Level 2.
E. Pre-stressed Concrete Institute (PCI) Plant Quality Personnel Certification – Level III.
F. American Welding Society (AWS) Certified Welding Inspector (CWI) or AWS Certified Associate Welding Inspector working under the direct on-site supervision of a CWI.
G. American Society for Nondestructive Testing (ASNT) Level II certification, or a Level III certification if previously certified as a Level II in the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
H. American Concrete Institute (ACI) Concrete Construction Special Inspector.
I. National Institute for Certification in Engineering Technologies (NICET) Level II or higher certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.
J. ACI Concrete Field Testing Technician with Grade 1 certification or Center for Training Transportation Professionals (CTTP) Certified Concrete Field Testing Technician.
K. American Concrete Institute (ACI) Masonry Field Testing Technician
L. NICET Certified Engineering Technologist (CT) competent in the specific task area.
M. Association of the Wall and Ceiling Industry (AWCI) EIFS Inspector Certification.
N. International Code Council (ICC) Commercial Building Inspector Certification.
O. International Code Council (ICC) Mechanical Inspector Certification.
P. Inspector has passed either the Underwriters Laboratory (UL) Firestop Contractor Program Examination or the Factory Mutual (FM) Firestop Examination.
Q. Pre-stressed Concrete Institute (PCI) Certified Field Auditor
R. Center for Training Transportation Professionals (CTTP) Certified Soil Testing Technician.
S. American Concrete Institute (ACI) Post-Installed Concrete Anchor Installation Inspector

Notes:

1. *The Special Inspector shall meet one of the minimum qualifications listed for the applicable Category of Testing and Inspection.*
2. *Materials testing shall be done by an Approved Testing Agency meeting the requirements of the Building Code Section 1703 and ASTM E 329.*

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Project identification sign.

I. Field offices.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:
   1. Electrical power , consisting of connection to existing facilities.
   2. Water supply, consisting of connection to existing facilities.

B. Provide and pay for all lighting, heating and cooling, and ventilation required for construction purposes.

C. Existing facilities may be used.

D. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

B. Provide telephone, cellular phone, and high-speed internet connection to jobsite.

C. Provide on jobsite capacity of viewing and printing out physical copies of electronic versions of construction documents, submittals, RFIs, ASI, etc.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

B. Used material may be used for construction fence. Provide duplicate keys of any gate lock to Owner. Contractor to be responsible for maintainence of fence for duration of project.

1.07 EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.08 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

A. Coordinate access and haul routes with governing authorities and Owner.

B. Provide and maintain access to fire hydrants, free of obstructions.

C. Provide means of removing mud from vehicle wheels before entering streets.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11 PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction as detailed by Architect.

B. Erect on site at location established by Owner.

C. Project Identification Signs:
   1. One painted sign, 64 square feet area, bottom 3 feet above ground.
   2. Content:
      a. Project title, logo and name of Owner as indicated on Contract Documents.
      b. Names and titles of authorities.
      c. Names and titles of Architect/Engineer.
      d. Name of Prime Contractor.
   3. Graphic Design, Colors, Style of Lettering: Designated by Architect/Engineer.

D. Sign Materials:
   1. Structure and Framing: New wood, structurally adequate.
   2. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4-inch thick, standard large sizes to minimize joints.
   3. Paint and Primers: Exterior quality, two coats; sign background of color as selected.
   4. Lettering: Exterior quality paint, contrasting colors as selected.

E. Installation:
   1. Install project identification signs within 15 days after date fixed by Notice to Proceed.
   2. Erect at location directed by the Architect.
   3. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
   4. Install signs surface plumb and level, with butt joints. Anchor securely.

5. Paint exposed surfaces of signs, supports, and framing.

F. Maintenance: Maintain signs and supports clean, repair deterioration and damage.

G. Removal: Remove signs, framing, supports, and foundations at completion of Project and restore the area.

H. No other signs are allowed without Owner permission except those required by law.

1.12 FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes: General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
2. Section 311000 "Site Clearing" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 015000 "Temporary Facilities and Controls".

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.

B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line for trees with caliper of 8 inches or greater as measured at a height of 12 inches above the ground.

C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Tree-service firm's personnel and equipment needed to make progress and avoid delays.

b. Arborist's responsibilities.
c. Quality-control program.
d. Coordination of Work and equipment movement with the locations of protection zones.
e. Trenching by hand or with air spade within protection zones, for installation of Work or for exploratory purposes to establish root locations.
f. Field quality control.

1.4 ACTION SUBMITTALS

A. Product Data:

1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. Shop Drawings:

1. Include plans, elevations, and sections showing trees and plants to be protected, locations of protection-zone fencing and signage, and the relationship between equipment-movement routes and material storage locations with protection zones.
2. Detail fabrication and assembly of protection-zone fencing and signage.
3. Indicate extent of utility boring and trenching by hand or with air spade within protection zones.
4. Include existing irrigation system that will be used to water plants.

C. Samples: For each type of the following:

1. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

D. Tree-Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction in accordance with recognized standards and that trees

were promptly and properly treated and repaired if damaged.

C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

E. Quality-control program.

1.6 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

B. Tree-Service Firm Qualifications: An experienced tree-service firm that has successfully completed temporary tree- and plant-protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection-zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.7 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Moving or parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

D. Take precautions to protect plants from airborne contaminants, such as paint or

fireproofing overspray.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements:

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb/ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches apart.

    a. Height: 48 inches.
    b. Color: High-visibility orange, nonfading.

2. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

B. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Lettering: 3-inch- high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by operations.

3.3 PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Landscape Architect.
2. Access Gates: Install where directed in the field; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
3. Plastic Fencing: Stretch fabric taut and secure to posts without bows or sags.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 50 ft. on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Maintain hydration of plants throughout duration of construction to assure plant survival.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Landscape Architect and remove when construction operations are complete and equipment has been removed from the site.

1. **Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone**.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or

taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.5 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as indicated on Drawings, under direction of arborist.

1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
3. Pruning Standards: Prune trees in accordance with ANSI A300 (Part 1).

    a. Type of Pruning: Cleaning where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

C. Cut branches with sharp pruning instruments; do not break or chop.

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and dispose of off-site.

3.6 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.7 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.8 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to

be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours in accordance with arborist's written instructions.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
2. Large Trees: Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.

    a. Species: As selected by Architect.

3. Plant and maintain new trees as specified in Section 329300 "Plants."

END OF SECTION 01 56 39

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Procedures for Owner-supplied products.

G. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Agreement.
   2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, manufacturer warranties and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be salvaged, re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, to become the property of the Contractor; remove from site.

C. Reused Products: Reused products include materials and equipment previously used in this or other construction, salvaged and refurbished as specified.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Made of wood from newly cut old growth timber.

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions.
   2. If wet-applied, have lower VOC content.
   3. Are extracted, harvested, and/or manufactured closer to the location of the project.

4. Have longer documented life span under normal use.
5. Result in less construction waste.
6. Are made of recycled materials.
7. Are Cradle-to-Cradle Certified.
8. Have a published GreenScreen Chemical Hazard Analysis.

D. Provide interchangeable components of the same manufacture for components being replaced.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

2.05 WARRANTY

A. For all products, where no specific extended warranty periord has been identified, provide no less than manufacturer's standard warranty for product line for quality grade specified.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
2. Arrange and pay for product delivery to site.
3. On delivery, inspect products jointly with Contractor.
4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
1. Review Owner reviewed shop drawings, product data, and samples. Notify Owner and Architect immediately if supplied product affects installed final work.
2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
3. Handle, store, install and finish products.
4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, and selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.02 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
   1. Structural integrity of any element of Project.
   2. Integrity of weather exposed or moisture resistant element.
   3. Efficiency, maintenance, or safety of any operational element.
   4. Visual qualities of sight exposed elements.
   5. Work of Owner or separate Contractor.

1.04 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State of Arkansas and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities.

B. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State of Arkansas. Employ only individual(s) trained and

experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State of Arkansas.

1.05 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

F. Utilize recognized engineering survey practices.

G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
   2. Grid or axis for structures.
   3. Building foundation, column locations, and ground floor elevations.

H. Periodically verify layouts by same means.

I. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.
   3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

C. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.

E. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

F. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

G. Refinish existing surfaces as indicated:
   1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
   2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

H. Clean existing systems and equipment.

I. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

J. Do not begin new construction in alterations areas before demolition is complete.

K. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate with requirements of Section 01 9113 - General Commissioning Requirements.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion. When each item is completed, have each item initialled by Project Superintendent and dated when completed. Include in project closeout documentation.

3.15 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Project Completion Documents.

B. Project Record Documents.

C. Operation and Maintenance Manuals.

D. Warranties and bonds.

1.02 SUBMITTALS

A. Close Out Document Manuals: All information to be scanned to digital format and submitted to Architect. Retain all hard copies for one complete set for the Owner. Submit complete sets of the following:
   1. Project Completion Documents:
   2. Project Record Documents:
   3. Operation and Maintenance Manuals:

B. Final Application for Payment: Submit fully executed

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT COMPLETION DOCUMENTS

A. Project Directory: Include list of all Contractors, Owner, Architects, Engineers, Subcontractor and prime material suppliers. List to include trade involved, primary contact name, phone number, mailing address and email address.

B. Waiver of Liens: Provide for all trades and prime material suppliers.

C. Warranties: Submit for contractors installation warranty, manufacturer's warranties and warranties for equipment or component parts of equipment. Warranty begins on the date of acceptance
   1. Submit for contractors installation warranty, manufacturer's warranties and warranties for equipment or component parts of equipment.
   2. Warranties begin on the Date of Substantial Completion, unless delayed or specifically excluded.
   3. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, the listing date of acceptance is the beginning of the warranty period.
   4. Verify that documents are in proper form, contain full information, and are notorized.
   5. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

D. Certificate of Substantial Completion: Provide fully executed form with punch list attached.

E. Contractor's Punch List: Provide completed list of items requiring completion or correction. Include any attachments for revisions provided by Architect and/or Engineer. Punch list should be noted that all items were corrected and completed with trade responsible identified.

F. Certificate of Occupancy: Provide form as issued for authority having jurisdiction.

G. Consent of Surety: Provide fully executed surety letter when project has associated bonds provided by contractor.

3.02 PROJECT RECORD DOCUMENTS

A. Record Drawings : Legibly mark construction drawings with each item to record actual construction including the following:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.
   6. Changes made by Addenda and Change Orders.
   7. Record information concurrent with construction progress.

B. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda, Change Orders and other modifications.

C. Addenda: Insure all addenda items have been includes and posted to record documents.

D. Change Orders: Include all executed Change Orders, Allowance purchases and other modifications to the contract.

E. Submittals, Shop Drawings, Product Data and Samples:
   1. Shop Drawings: Include records of manufacturer's instruction for assembly, installation and adjusting.
   2. Product Data: Include list of all products and model number provided.
   3. Samples: Include material samples of all selected interior finishes. Samples to include label indicating manufacturer, product model number, color, finish and other identifying elements. Full color photographs are acceptable for larger samples.

F. Test Reports and Special Inspections:

G. Maintain on site a complete set of record documents; record actual revisions to the Work:

H. Ensure entries are complete and accurate, enabling future reference by Owner.

I. Store record documents separate from documents used for construction.

J. Record information concurrent with construction progress.

3.03 OPERATION AND MAINTENANCE MANUAL - GENERAL

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.04 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.05 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. Provide schedule of all equipment that require instruction on operation and/or continual maintenance. Coordinate instruction for all equipment with Owner and/or Owner's Representative and record name and contact information of all in attendance. Video recording of instructions provided is recommended.

B. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

D. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Additional Requirements: As specified in individual product specification sections.

3.06 CLOSE OUT DOCUMENT MANUALS

A. Provide all Close Out information in digital format, saved in PDF files, and neatly organized for ease of navigation. Arrange by Specification Sections as Table of Contents. Architect can provide file format for use as needed.

B. Where paper documents are provided by manufacturers, scan into records and combine and include into Hard Copy Close Out Documents.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.

G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

H. Arrange content by systems under specification section numbers and sequence of Table of Contents of this Project Manual.

I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Operating instructions.
   2. Maintenance instructions for equipment and systems.
   3. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
   4. Air and water balance reports.
   5. Certificates.
   6. Photocopies of warranties and bonds.

J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect , Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

L. Arrange digital PDF copies of documents in similar fashion using file folders. Name file type with simple explanation of contents using shortest file names type possible. Provide digital files on flash USB drives.

M. Provide owner training videos saved electronically and transmitted in USB drives. Provide sign-in sheets for all attendees for Owner Training sessions and include in closeouts.

3.07 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.
   2. Plumbing equipment.
   3. Electrical systems and equipment.
   4. Greenhouse systems and equipment.
   5. Landscape irrigation.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.
   2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Provide training in minimum two hour segments.

C. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

D. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

E. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.

5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 7320
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Demolition and removal of selected portions of a building or structure.

1.02 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 Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. 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.

1.03 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
   2. Coordination for shutoff, capping, and continuation of utility services.
   3. Means of protection for items to remain and items in path of waste removal from building.

B. Landfill Records for Hazardous Waste: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous waste.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Predemolition Conference: Conduct conference at Project site to comply with requirements. Review methods and procedures related to selective demolition including, but not limited to, the following:
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review structural load limitations of existing structure, and temporary shoring requirements.
   3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   5. Review areas where existing construction is to remain and requires enclosure or temporary protection.

1.05 PROJECT CONDITIONS

A. Notify the Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

B. Hazardous Materials: See Section 00 3100 - Available Project Information for reports available.

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

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped.

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

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

D. 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 the Architect.

E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.

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

3.02 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.
   1. Comply with requirements for existing services/systems interruptions specified in Section 01 1000 - Summary.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Building manager will arrange to shut off indicated services/systems when requested by Contractor.
   2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
   3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
   4. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

3.03 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 Section 01 5000 - 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.
   1. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   2. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 5000 - Temporary Facilities and Controls.

3.04 SELECTIVE DEMOLITION, GENERAL

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. Remove decayed, pest- or vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

2. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
3. Dispose of demolished items and materials promptly.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their designated locations after selective demolition operations are complete.

3.05 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be 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.
1. Do not allow demolished materials to 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 demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.06 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

SECTION 03 11 00

CONCRETE FORM WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. All concrete and related items required to complete the building, provide off-sets, bulkheads, recesses, openings, chases, etc., and install any inserts, sleeves, etc., required by other trades.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Concrete: Section 03 30 00

B. Concrete Reinforcement: Section 03 21 00

1.3 WORK INSTALLED BUT FURNISHED BY OTHER SECTIONS:

A. Built-in anchors, inserts and bolts for connection of other materials.

B. Built-in sleeves, thimbles, dovetail slots, and water-stops.

1.4 DEFINITIONS:

A. Architectural Concrete Surfaces: Formed surfaces where appearance is of major importance.

B. Non-Architectural Concrete Surfaces: Formed surfaces where appearance is not of major importance.

1.5 QUALITY ASSURANCE:

A. Design Criteria:
   1. General: Conform to ACI 347-Current Edition Chapter 1, Design.
   2. Plywood: Conform to tables for form design in APA Form V 345- Current Edition, including strength.

B. Requirements of Regulatory Agencies: Erect forms to meet requirements of the Local Building Code.

C. Allowable Tolerances:
   1. Non-Architectural Concrete: Conform to ACI 347- Current Edition.

D. Contractor shall assume full responsibility for earthwork or an existing structure used as a form and such form work must meet all requirements of this section.

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1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. On delivery to job site, place materials in area protected from weather.

B. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Handle materials to prevent damage.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Conform to ACI 347- Current Edition, Chapter 3, Materials and Form Work.

2.2 LUMBER:

A. Softwood framing lumber: Kiln dried, PS 20-70.

B. Boards less than 1 1/2" thick, used for basic forms and form liners: Kiln dried.

C. Grade marked by grading rules agency approved by American Lumber Standards Committee.

D. Light framing or studs for plywood forms, 2 in. to 4 inches in width and thickness, construction grade.

2.3 PLYWOOD:

A. Exterior type softwood plywood, PS 1-66.

B. Each panel stamped or branded indicating veneer grades, species, type and identification.

C. Wood faced plywood for architectural concrete surfaces. Panel veneer grades: A-C. Mill-oiled sides and mill-sealed edges of panels.

2.4 CORNER FORMERS:

A. Profile type: chamfered face.

B. Material: Wood

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2.5 TIES:

A. Material: Carbon Steel

B. Type: Snap ties

C. Depth of break back: 1 inch

D. Maximum diameter: 1/4 inch

2.6 FORM COATINGS:

A. Plywood and wood forms shall be sealed against absorption of moisture from the concrete with an approved non-staining form oil or sealer.

B. Form sealer, lacquer or any form of release agents containing wax, oil, or other materials that would interfere with adhesion shall not be used on form work for concrete which is to receive exposed aggregate coatings.

PART 3 EXECUTION:

3.1 GENERAL

A. The design, engineering, bracing and construction of form work shall be the responsibility of the Contractor.

B. Form work shall conform to shapes, lines and dimensions of members as shown on contract plans and shall be sufficient to prevent mortar leakage and to maintain position and shape during and after placing of concrete. Form work for exposed surfaces shall be constructed of undamaged materials that will result in an unblemished, flush surface when removed.

C. Shoring and bracing of form work shall be adequate to resist all construction loads, wet concrete, stored and lateral loads due to earthwork.

D. Preparation of forms. Edges of exposed concrete work, exterior and interior shall be pointed up to present a good square appearance.

E. Provide temporary openings in framework for concrete placement.

F. Removal of forms is subject to weather conditions after concrete is poured. Remove formwork in manner to ensure complete safety of structure. Do not place building materials on slabs until they are strong enough to carry the imposed load. Contractor shall decide when to remove and accept full responsibility for their removal.

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G. Do not run reinforcement, corner protection angles, or related fixed metal items, embedded in or bonded into concrete through expansion joints. Provide filler strips for expansion joints between slabs on grade and all joints between slabs on grade and vertical surfaces. Construct joints ½ inch wide and full depth of slab unless noted otherwise.

END OF SECTION

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SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction contraction and isolation joints.
c. Steel-reinforcement installation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Epoxy repair coating.
3. Zinc repair material.
4. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For testing and inspection agency.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

C. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

D. Field quality-control reports.

E. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage and to avoid damaging coatings on steel reinforcement.

1. Store reinforcement to avoid contact with earth.
2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 80, deformed.

B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

D. Galvanized Reinforcing Bars:

1. Steel Bars: ASTM A615/A615M, Grade 80, deformed bars.
2. Zinc Coating: ASTM A767/A767M, Class I zinc coated after fabrication and bending.

E. Epoxy-Coated Reinforcing Bars:

1. Steel Bars: ASTM A615/A615M, Grade 80, deformed bars.
2. Epoxy Coating: ASTM A775/A775M with less than 2 percent damaged coating in each 12-inch bar length.

F. Dual-Coated Reinforcing Bars: ASTM A1055/A1055M.

1. Steel Bars: ASTM A615/A615M, Grade 80, deformed bars.
2. Zinc Coating: ASTM A1055/A1055M Type I.
3. Epoxy Coating: ASTM A775/A775M with less than 2 percent damaged coating in each 12-inch bar length.

G. Stainless Steel Reinforcing Bars: ASTM A955/A955M, Grade 75, Type 316L, deformed.

H. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

I. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

J. Galvanized-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from galvanized-steel wire into flat sheets.

K. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A coated, Type 1, plain steel.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, ASTM A775/A775M epoxy coated.

C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
b. For epoxy-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
c. For dual-coated reinforcement, use CRSI Class 1A epoxy-coated or other dielectric-polymer-coated wire bar supports.
d. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
e. For stainless steel reinforcement, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

D. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: ASTM A884/A884M, Class A, Type 1, epoxy coated, with less than 2 percent damaged coating in each 12-inch wire length.

E. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch in diameter.

F. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

G. Zinc Repair Material: ASTM A780/A780M.

2.3 FABRICATING REINFORCEMENT

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
4. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install structural thermal break insulated connection system in accordance with manufacturer's instructions.

H. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

    a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

I. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with

epoxy repair coating in accordance with ASTM D3963/D3963M.

J. Dual-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating in accordance with ASTM D3963/D3963M.

K. Zinc-Coated Reinforcement: Repair cut and damaged zinc coatings with zinc repair material in accordance with ASTM A780/A780M.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:

1. Steel-reinforcement placement.
2. Steel-reinforcement mechanical splice couplers.
3. Steel-reinforcement welding.

C. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION 03 20 00

SECTION 03 21 00

CONCRETE REINFORCEMENT

PART 1 GENERAL

1.1 Section Includes:

A. All steel reinforcement, mesh, dowels, and related items to comply with drawings and specifications including materials, labor, and equipment to complete the building and work shown.

B. Observation and Required Special Inspections

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Section 01 40 00 – Quality Control: Required Special Inspections

B. Section 03 11 00 - Concrete Form Work: Section

C. Section 03 30 00 - Cast-In-Place Concrete

D. Section 04 22 00 - Concrete Unit Masonry

1.3 QUALITY ASSURANCE:

A. Acceptable Manufacturers: Regularly engaged in manufacture of steel bar and welded wire fabric reinforcing.

B. Installer Qualifications:
   1. Three years experience in installation of steel bar and welded wire fabric reinforcing.

C. Requirements of Regulatory Agencies: Conform to requirements of local Building Code.

D. Allowable Tolerances:
   1. Fabrication:
      a. Sheared length: + or - 1 inch
      b. Stirrups, ties and spirals: + or - 1/2 inch
      c. All other bends: + or - 1 inch
   2. Placement:
      a. Concrete cover to form surfaces: + or - 1/4 inch
      b. Minimum spacing between bars: + or - 1/4 inch
      c. Top bars in slabs and beams:
         (1) Members 8 inches deep or less: + or - 1/4 inch
         (2) Members more than 8 inches, but not over 2 feet deep:+ or - 1/2 inch
         (3) Members more than 2 ft. deep: + or - 1 inch

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d. Crosswise of members: Spaced evenly within 2 inches of stated separation.
e. Lengthwise of members: + or - 2 inches.

3. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1 bar diameter.

1.4 SHOP DRAWINGS:

A. Show sizes and dimensions for fabrications and placing of reinforcing steel and bar supports.

B. Indicate bar schedule, stirrup spacing, and diagrams of bend bars.

C. All detailing, fabrication and erection of reinforcing bars shall comply with the A.C.I. Manual of Standard Practice for Detailing Reinforced Concrete Structures. (A.C.I. 315).ACI 315R- 18 is titled “Guide to Presenting Reinforcing Steel Design Details.”

D. Manufacturer's Literature: Manufacturer's specifications and installation instructions for splice devices.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING:

A. Deliver reinforcement to project site in bundles marked with durable tags indicating bar size and length.

B. Handle and store materials to prevent contamination.

PART 2 PRODUCTS

2.1 MATERIALS

A. REINFORCING STEEL. Reinforcing steel for concrete shall be deformed, clean, free from rust and new. It shall conform to ASTM Standard A 615 and shall be Grade 60 for bars No. 4 and larger and Grade 40 for No. 3 bars and smaller.

A. SMOOTH STEEL DOWEL BARS. Plain steel dowel bars for reinforcing concrete slab joints shall meet the requirements of ASTM A 615, Grade 60. These plain round dowel bars shall be free from burrs or other deformations restricting slippage in the concrete.

1. Smooth Dowel bars shall be held in position parallel to the surface and centerline of the slab by a metal assembly of sufficient strength and anchorage to prevent displacement during the paving operations. Immediately prior to placement of concrete, each bar shall be field coated for a minimum distance of 2 inches greater than half the length of the bar with an approved lubricant. Lubricated ends of adjacent bars shall be on alternating sides of the slab joint.

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B. WIRE FABRIC. Wire fabric shall be electrically-welded wire fabric of cold-drawn wire (70,000 psi yield point) of the diameter and spacing required and shall conform to ASTM Standard A 185. Welded wire fabric or mesh shall be of gauge and mesh shown on plans and shall conform to "Standard Specifications for Welded Steel Wire Fabric for Concrete REINFORCEMENT: (ASTM A1064-Current Edition). Furnish mesh in flat sheets. ASTM A1064/A1064M – 17 is titled “Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.”

D. TIE WIRE: FS-QQ-W-461, annealed steel, black, 16 gauge minimum

E. BAR & WIRE MESH SUPPORTS: Conform to "Bar Support Specifications", CRSI Manual of Standard Practice. Metal bolsters required. No bricks or CMU allowed. Bars supports used over or against concrete surfaces which are exposed shall be plastic protected. The plastic shall have a thickness of 3/32" or greater at points of contact with the form work. The plastic shall extend upward on the wire to a point at least 1/2" above the form work. Provide following support types (CRSI Designation):
   1. Woven Wire Mesh: Type “SBU”, linear, longest length possible.
   2. Steel reinforcement bars: Type “SBU”, length as required to fit in trench and properly support bars.
   3. Note: “SBU” type supports to have two (2) bottom runners and one (1) top runner, all continuous.

F. DIAMOND PLATE DOWEL SYSTEM: Provide Diamond Dowel System manufactured by PNA construction technologies, “Speed Plate” System by Greenstreak Group, Inc. or approved alternate. Plates are manufactured from steel certified to meet ASTMA36 (1/4” and 3/8”) or ASTM A108 (3/4”)
   1. Install at all construction joints at building slabs-on-grade.
   2. Provide diamond plate thickness as follows, depending on slab thickness:
      a. 1/4” (6mm) – typically used in 4”- 6” slab depths
      b. 3/8” (10 mm) – typically used in 7”- 8” slab depths
      c. 3/4” (20 mm) – typically used in 9” plus slab depths

G. FIBER REINFORCEMENT Refer to Section 03 30 00.

PART 3 EXECUTION

3.1 FABRICATION

A. In accord with CRSI Manual of Standard Practice.

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3.2 INSTALLATION:

A. Placements:
1. Bar Supports: CRSI Placing Reinforcing Bars (10th Edition)
2. Reinforcing Bars: CRSI Supports for Reinforcement Used in Concrete (2016). Support footing reinforcement bars with SBU type supports. Space at no more than 4'-0" on center. Support reinforcement bars at each footing corner and intersection. **Rebar chairs will not be acceptable.** For large double layer reinforcement pad footing mats, provide doubling of the SBU supports. Concrete bricks may be used as an option at large double-matted footings, **but only upon Architect's approval**.
3. Details shall be in accordance with "Building Code Requirements for Structural Concrete" (ACI 318-Current Edition)
4. **Place sufficient length supports for wire mesh concrete slab reinforcement no more than 3'-0" on center, or stagger at 2'-0" on center. Do not cut supports into small lengths.** Do not extend supports through control joints.
5. Install #4 reinforcement hoops around slab penetrations 3" or larger in diameter. This would include, but not be limited to plumbing pipe, electrical conduit, floor drains, electrical floor boxes, etc.
6. Where groups of electrical conduits exceed 3" in diameter, install #4 reinforcement hoops around groups, or provide straight #4 bars around linear groups.

B. Steel Adjustment:
1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
2. Do not move bars beyond allowable tolerances without concurrence of Architect/Engineer.
3. Do not heat, bend, or cut bars without concurrence of Architect/Engineer.

C. Concrete covering over reinforcement shall be not less than the following:
1. Where concrete is deposited directly against earth: 3"
2. Where formed concrete surface will be exposed to weather or ground: 2"
3. Where formed concrete surface will not be exposed to weather or ground: for walls and slabs: 3/4"
4. For beams, girders and columns: 1-1/2"
5. All covering: Nominal bar diameter

D. Splices:
1. Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
2. Splice devices: Install in accordance with manufacturer's written instructions.
3. Welding: Do not weld reinforcement.
4. Do not splice bars except at locations shown on drawings without concurrence of Architect/Engineer.

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E. Wire Fabric:
   1. Install in longest practicable length.
   2. Lap adjoining pieces one full mesh minimum, and lace splices with 16 gauge wire.
   3. Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
   4. Offset end laps in adjacent widths to prevent continuous laps.
   5. Do not continue wire fabric through control joints
F. Diamond Plate Dowel System:
   1. Install Diamond Plate Dowell System, following manufacturer's instructions.
   2. Provide diamond plate dowel spacing as follows, depending on slab thickness:
      a. 4" -6" slab thickness: ¼" thick at 18" O.C.
      b. 7" -8" slab thickness: 3/8" thick at 18" O.C.
      c. 9" -11" slab thickness: ¾" thick at 20" O.C.

3.3 CLEANING:

A. Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

3.4 . PROTECTION DURING CONCRETING:

A. Keep reinforcing steel in proper position during concrete placement.

3.5 OBSERVATION AND SPECIAL INSPECTIONS

A. Reinforcement and placement shall be observed by the Architect/Engineer prior to placing concrete. Inspection of reinforcement for conformance to the construction documents shall be completed by the designated third party Special Inspector.

3.6 INSTALLATION OF MISCELLANEOUS ITEMS:

A. Contractor shall coordinate and check that all work required to be embedded in concrete is in place prior to pouring. Placement of such work is to be done without disturbing reinforcing in place.

END OF SECTION

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SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete standards.
2. Concrete materials.
3. Admixtures.
4. Concrete mixture materials.
5. Concrete mixture class types.
6. Concrete mixing.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement or blended hydraulic cement alone or in combination with one or more of the following:

1. Fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cementitious Materials (w/cm) Ratio: The ratio by weight of mixing water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Concrete Subcontractor.

2. Review the following:

a. Special inspection and testing and inspecting agency procedures for field quality control.
b. Construction joints, control joints, isolation joints, and joint-filler strips.
c. Semirigid joint fillers.
d. Anchor rod and anchorage device installation tolerances.
e. Cold- and hot-weather concreting procedures.
f. Concrete finishes and finishing.
g. Curing procedures.
h. Forms and form-removal limitations.

i. Concrete repair procedures.
j. Concrete protection.
k. Initial curing of standard-cured and field curing of field-cured test cylinders (ASTM C31/C31M.)
l. Protection of field cured field test cylinders.
m. Distribution of test reports.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Joint fillers.
7. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Compressive strength at 28 days or other age as specified.
3. Compressive strength required at stages of construction.
4. Durability exposure classes for Exposure Categories F, S, W, and C.
5. Maximum w/cm ratio.
6. Calculated equilibrium and fresh density for lightweight concrete.
7. Slump or slump flow limit.
8. Air content.
9. Nominal maximum aggregate size.
10. Steel-fiber reinforcement content.
11. Intended placement method.
12. Submit adjustments to design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant changes.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

    a. Location of construction joints is subject to approval of the Landscape Architect.

D. Concrete Schedule: For each location of each class of concrete indicated in "Concrete Mixture Class Types" Article, including the following:

1. Concrete class designation.
2. Location within Project.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Testing Agency: Include documentation indicating compliance with ASTM E329 or ASTM C1077 and copies of applicable ACI certificates for testing technicians or ACI Concrete Construction Special Inspector - MH, ASCC.

B. Material Certificates: For each of the following:

1. Cementitious materials.
2. Admixtures.
3. Adhesives.
4. Semirigid joint filler.
5. Joint-filler strips.
6. Repair materials.

C. Material Test Reports: For the following:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Ground calcium carbonate and aggregate mineral filler.
7. Admixtures.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances in accordance with ACI 117 and in compliance with ASTM E1155.

E. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC's Acceptance Criteria AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer's production facilities and delivery vehicles certified in accordance with NRMCA's certification requirements or equivalent approval by a State DOT.

B. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing that performs duties on behalf of the Landscape Architect/Engineer.

1. Personnel performing laboratory tests to be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Level 1. Testing agency laboratory supervisor tests to be an ACI-certified Concrete Laboratory Testing Technician, Level 2.

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

1. Personnel conducting field tests on plastic concrete properties are to be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with policies from ACI CPP 610.1 or an equivalent certification program.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on each concrete mixture.

1. Include the following information in each test report:

a. Admixture dosage rates.
b. Slump.
c. Air content.
d. Seven-day compressive strength.
e. 28-day compressive strength.
f. Evaluation of permeability-reducing admixtures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 as follows:

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When air temperature has fallen to, or is expected to fall below 40 deg F during the protection period, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE STANDARDS

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, gray.
2. Pozzolans: ASTM C618, Class C, F, or N.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates:

1. Coarse Aggregate: ASTM C33/C33M, Class 3S
2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: ASTM C33/C33M.
4. Recycled Aggregate: Provide documentation of characteristics of recycled aggregate and mechanical properties and durability of proposed concrete, which incorporates recycled aggregate to conform to appliable requirements for the class of concrete.
5. Alkali-Silica Reaction: Comply with one of the following for each aggregate used:

a. Expansion Result of Aggregate: Not more than 0.04 percent at one year when tested in accordance with ASTM C1293.
b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when

tested in accordance with ASTM C1567. Do not use this option with fly ash with an alkali content greater than 4.0 percent. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent when tested in accordance with ASTM C1260.

c. Alkali Content in Concrete: Not to exceed 4 lb./cu. yd. for aggregate with expansion greater than or equal to 0.04 percent and less than 0.12 percent or 3 lb./cu. yd. for aggregate with expansion greater than or equal to 0.12 percent and less than 0.24 percent. Test aggregate reactivity in accordance with ASTM C1293. Calculate alkali content of concrete in accordance with ACI 301. Do not use this option with natural pozzolan or fly ash that has a calcium oxide content greater than 18 percent or an alkali content greater than 4.0 percent; or for an aggregate with expansion at one year greater than or equal to 0.24 percent when tested in accordance with ASTM C1293.

2.3 ADMIXTURES

A. Air-Entraining Admixture: ASTM C260/C260M.

B. Chemical Admixtures: Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
6. Admixtures with special properties, with documentation of claimed performance enhancement, ASTM C494/C494M, Type S.

2.4 CONCRETE MIXTURE MATERIALS

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland or hydraulic cement in concrete assigned to Exposure Class F3 as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.
2. Slag Cement: 50 percent by mass.
3. Silica Fume: 10 percent by mass.
4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50

percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
2. Use permeability-reducing admixture in concrete mixtures where indicated.

D. Color Pigment: Add color pigment to concrete mixture in accordance with manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.5 CONCRETE MIXTURE CLASS TYPES

A. Class A: Normal-weight concrete used for footings, grade beams, and tie beams.

1. Exposure Class: ACI 318 Class F3.
2. Minimum Compressive Strength: 4500 psi at 56 days.
3. Maximum w/cm Ratio: 0.50.
4. Slump Limit: 5 inches, plus or minus 1-1/2 inches for concrete <**Insert limits**>.
5. Air Content:

a. Exposure Classes F2 and F3: 6.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M and furnish delivery ticket.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 TOLERANCES

A. Comply with ACI 117.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.5 INSTALLATION OF CAST-IN-PLACE CONCRETE

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

B. Notify Landscape Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Water addition in transit or at the Project site must be in accordance with ASTM C94/C94M and must not exceed the permitted amount indicated on the concrete delivery ticket.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.

a. Do not use vibrators to transport concrete inside forms.
b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.6 INSTALLATION OF JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Landscape Architect.
2. Place joints perpendicular to main reinforcement.

a. Continue reinforcement across construction joints unless otherwise indicated.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated on Drawings.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface, where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.
2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.7 APPLICATION OF FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/4 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117, Class B.
    e. Locations: Apply to concrete surfaces exposed to public view,.

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:

1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to match color and texture with in-place construction exposed to view.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
5. Prior to pouring concrete, place and secure anchorage devices.

    a. Use setting drawings, templates, diagrams, instructions, and

directions furnished with items to be embedded.
b. Cast anchor-bolt insert into bases.
c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 APPLICATION OF CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h, calculated in accordance with ACI 305R, before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. If forms remain during curing period, moist cure after loosening forms.
3. If removing forms before end of curing period, continue curing for remainder of curing period as follows:

a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
b. Continuous Sprinkling: Maintain concrete surface continuously wet.
c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing after finishing concrete.

3.10 INSTALLATION OF JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.11 INSTALLATION OF CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Landscape Architect.
2. Remove and replace concrete that cannot be repaired and patched to meet specification requirements.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks in excess of 0.01 inch spalls, air bubbles exceeding surface finish limits, honeycombs, rock pockets, fins and other projections on the surface exceeding surface finish limits, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete.

    a. Limit cut depth to 3/4 inch.
    b. Make edges of cuts perpendicular to concrete surface.
    c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    d. Fill and compact with patching mortar before bonding agent has dried.
    e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and match surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance, as determined by Landscape Architect.

D. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width.
3. After concrete has cured at least 14 days, correct high areas by grinding.
4. Correct localized low areas during, or immediately after, completing surface-finishing operations by adding patching mortar.

    a. Finish repaired areas to blend into adjacent concrete.

5. Correct other low areas scheduled to receive floor coverings with a repair underlayment.

    a. Prepare, mix, and apply repair underlayment and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
    b. Feather edges to match adjacent floor elevations.

6. Correct other low areas scheduled to remain exposed with repair topping.

    a. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations.
    b. Prepare, mix, and apply repair topping and primer in accordance with manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

7. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete.

    a. Remove defective areas with clean, square cuts, and expose steel reinforcement with at least a 3/4-inch clearance all around.
    b. Dampen concrete surfaces in contact with patching concrete and apply bonding agent.
    c. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate.
    d. Place, compact, and finish to blend with adjacent finished concrete.
    e. Cure in same manner as adjacent concrete.

8. Repair random cracks and single holes 1 inch or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean

off dust, dirt, and loose particles.
b. Dampen cleaned concrete surfaces and apply bonding agent.
c. Place patching mortar before bonding agent has dried.
d. Compact patching mortar and finish to match adjacent concrete.
e. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Landscape Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Landscape Architect's approval.

3.12 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency to be responsible for providing curing facility for initial curing of strength test specimens on-site and verifying that test specimens are cured in accordance with standard curing requirements in ASTM C31/C31M.
2. Testing agency to immediately report to Landscape Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Landscape Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results of fresh concrete, including slump or slump flow, air content, temperature and density.
13) Information on storage and curing of samples at the Project

site, including curing method and maximum and minimum temperatures during initial curing period.

14) Type of fracture and compressive break strengths at seven days and 28 days.

4. Provide a space and source of power or other resources for curing and access to test specimens by the testing agency.

C. Delivery Tickets: comply with ASTM C94/C94M.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 150 cu. yd. or fraction thereof.

   a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing is to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

   a. One test at point of delivery for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

3. Slump Flow: ASTM C1611/C1611M:

   a. One test at point of delivery for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.
   b. Perform additional tests as needed.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; .

   a. One test for each composite sample when strength test specimens are cast, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample when strength test specimens are cast.

6. Concrete Density: ASTM C138/C138M:

a. One test for each composite sample when strength test specimens are cast.

7. Unit Weight: ASTM C138/C138M density of fresh structural lightweight concrete.

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture. The fresh density should be consistent with that associated with the equilibrium density within a tolerance of plus or minus 4 lb/ft.3.

8. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and standard cure two sets of two 6 inches by 12-inches or 4-inch by 8-inch cylindrical specimens for each composite sample.
   b. Cast, and field cure two sets of two standard cylindrical specimens for each composite sample.

9. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two standard cured specimens at seven days and one set of two specimens at 28 days.
   b. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

10. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
11. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests of standard cured cylinders equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Landscape Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests:

    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Landscape Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Landscape Architect.

1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.7.6.3.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Prohibit use of pipe-cutting machinery over concrete surfaces.
3. Prohibit placement of steel items on concrete surfaces.
4. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 03 30 00

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Pier Caps.
   2. Foundation walls.
   3. Grade beams.
   4. Slabs-on-grade.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash and other pozzolans; subject to compliance with requirements.

1.04 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments. Two weeks prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier, for class of concrete, including recent test results per ACI 318 substantiating the quality of concrete produced by each mix.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.
   1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and reshoring installation and removal.

E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect and Engineer.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Fiber reinforcement.
   6. Waterstops.
   7. Curing compounds.
   8. Bonding agents.
   9. Adhesives.

10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field-Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301, "Specifications for Structural Concrete."
   2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   3. ACI 318, "Building Code Requirements for Reinforced Concrete."
   4. CRSI, "Manual of Standard Practice."

G. Concrete Testing Service: Owner to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.07 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.01 ENVIRONMENTAL CONSIDERATIONS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 60 percent.

B. Provide products which are extracted, harvested or recovered, and manufactured within 500 miles of project site.

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

E. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

F. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

G. Form Materials: Contractor shall provide form materials with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.

H. Earth Cuts: Don not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side form.

2.03 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.

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

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices (not bricks or stones) for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire and plastic as follows:
   1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
   3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.
   4. For slabs-on-grade, use supports with sand plates or horizontal runners when base material will not support chair legs.

2.05 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II.
      a. Fly Ash: ASTM C 618, Class F or C. Slag is not acceptable.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches at foundations and 3/4 inch at slabs and walls nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
   3. Polished Concrete Special Seeding aggregate: Red Glass, size to be 3/8 inch minimum to 1/2 -ich maximum at a quantity of 1-lb of glass square foot.

C. Lightweight Aggregate: ASTM C 330, 1-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.06 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.07 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Factory-fabricate corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Greenstreak.
      b. Williams Products, Inc.
      c. BoMetals, Inc.
      d. Paul Murphy Plastics Company.
      e. Vinylex Corp.
   2. Profile: Ribbed with center bulb.
   3. Dimensions: 9 inches by 3/8 inch thick; nontapered.

B. Waterstops: Cetco Volclay RX and Hydrotite as shown on drawings.

2.08 VAPOR BARRIER

A. Sheet Vapor Barrier: Polyethylene sheet, ASTM D 4397, not less than 15 mils thick as manufactured by Stego Industries LLC or approved equal.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.09 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Confilm.
      b. ChemMasters; SprayFilm.
      c. Conspec by Dayton Superior; Aquafilm.
      d. Dayton Superior Corporation; Sure Film (J-74).
      e. Edoco by Dayton Superior; BurkeFilm.
      f. Euclid Chemical Company (The), an RPM company; Eucobar.
      g. L&M Construction Chemicals, Inc.; E-CON.
      h. Meadows, W. R., Inc.; EVAPRE.
      i. Sika Corporation; SikaFilm.
      j. SpecChem, LLC; Spec Film.
      k. Symons by Dayton Superior; Finishing Aid.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating, clear or translucent.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Kure 200.
      b. ChemMasters; Safe-Cure Clear.
      c. Conspec by Dayton Superior; W.B. Resin Cure.
      d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      e. Edoco by Dayton Superior; Res X Cure WB.
      f. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      g. L&M Construction Chemicals, Inc.; L&M Cure R.
      h. Meadows, W. R., Inc.; 1100-CLEAR.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, non-dissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
      b. ChemMasters; Safe-Cure & Seal 20.
      c. Conspec by Dayton Superior; Cure and Seal WB.
      d. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.
      e. Dayton Superior Corporation; Safe Cure and Seal (J-18).

f. Edoco by Dayton Superior; Spartan Cote WB II.
g. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
h. L&M Construction Chemicals, Inc.; Dress & Seal WB.
i. Symons by Dayton Superior; Cure & Seal 18 Percent E.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
g. Meadows, W. R., Inc.; Vocomp-30.
h. Symons by Dayton Superior; Cure & Seal 31 Percent E.
2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.10 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, non-extruding premolded materials.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types I and II, non-load bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034-inch-thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

G. Non-Shrink, Non-Metallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF (Master Builders), Masterflow 713 Plus.
b. Euclid, Euco NS Grout.
c. W.R. Meadows, Sealtight 588 Grout.

H. Saw Cut Control Joint Filler: Elastomeric sealant.

2.11 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.

2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.12 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Use fly ash as needed to reduce the total amount of Portland cement, which would otherwise be used, by not more than 20 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings/Foundation Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: as shown on the Design Drawings at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches; 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size.

B. Slabs-on-Grade/Elevated Slab: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: as shown on the Design Drawings at 28 days.
2. Slump Limit: 4 inches, plus or minus 1 inch.
3. Air Content: 1.5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
5. Maximum Water-Cementitious Materials Ratio: 0.45

C. Exterior Concrete Exposed To Weather: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: as shown on the Design Drawings at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches.
4. Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size. Do not allow air content of troweled finished toppings to exceed 3 percent.

2.14 FABRICATING REINFORCEMENT

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

2.15 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - PRODUCTS

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch Class C, 1/2 inch Class D, 1 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEMS

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

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
   1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

D. Formwork supporting weight of concrete (slab and beam soffits) may be removed after concrete has reached a strength of 3000 psi, but must be immediately re-shored. In the case of post-tensioned slabs, all of the cables can be stressed when the concrete strength reaches 3000 psi. The cables must all be stressed before any shoring or forms are removed. The design, detailing, placement, and removal schedule for formwork is the contractor’s responsibility, but

shall be done in accordance with ACI 347 and ACI 347.2R. The re-shoring of concrete shall continue down a sufficient number of floors (3 minimum) to distribute the wet weight of the concrete floor being cast and the construction loads on it so that none of the floors below are overstressed.

3.05 VAPOR BARRIERS

A. Sheet Vapor Barrier: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints and seal with manufacturers recommended tape.

3.06 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.07 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   6. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.08 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.09 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
   1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view.

C. Rubbed Concrete Finish: Apply the following to smooth-formed finished as cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
   1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.
   2. Finish surfaces to tolerances of F(F) 25 (Floor Flatness) and F(L) 20 (Floor Leveling) measured according to ASTM E 1155.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20 for slabs-on-grade.
      b. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20 for suspended slabs.
   3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval. Take pictures and send to Architect for approval before starting work.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

D. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   1. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   2. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

F. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

G. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
   1. Steel reinforcement placement.
   2. Steel reinforcement welding.
   3. Headed bolts and studs.
   4. Verification of use of required design mixture.
   5. Concrete placement, including conveying and depositing.
   6. Curing procedures and maintenance of curing temperature.
   7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173/C 173M, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder
    b. Specimens for each composite sample.
    c. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M.
    a. Test one field-cured specimen at 7 days and one set of two specimens at 28 days. Reserve the remaining for testing after a longer period as required by Architect if the 28-day tests do not meet the required strength.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents at Contractor's expense.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION

SECTION 03 35 23 - Exposed Aggregate Concrete Finishing

PART I- GENERAL

1.01 SUMMARY

A Section Includes:

1. Finishing materials and methods for producing decorative exposed aggregate slab and wall finish, including the use of chemical surface retarders
2. Curing and sealing of concrete surfaces.

B Related Sections:

1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections
2. Section 03 30 00 Cast in Place Concrete

1.02 REFERENCES

A. ASTM International (www.astm.org)

B. American Concrete Institute (www.concrete.org)

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:

1. Attendance: Contractor, Subcontractor, Owner, Landscape Architect, Construction Manager, and related trades.
2. Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

1.04 SUBMITTALS

A Action Submittal

1. Shop Drawings including patterns and exposure depths
2. Product Data: Manufacturer's descriptive data and product attributes for each product.
3. Samples: Aggregates, color additives.

B Informational Submittal

1. VOC Compliance
   a. Based on SCAQMD Rule 1113 for VOC compliance
      i. Concrete surface retarder, not to exceed 250 g/l or comply with the low solids exception of less than 80 g/l.
      ii. Sealers, not to exceed 100 g/l.
   b. Or CDPH Standard 1.2 VOC Emissions compliant

1.05 QUALITY ASSURANCE

A Installer Qualifications: Minimum 5 years' experience in work of this Section.

C Mockups: Minimum 4 x 4 feet. Show each concrete color and finish for three different options as coordinated with Landscape Architect.

1. Prepare mock-up panels at the project site to demonstrate proficiency of the contractor as well as determine the best procedures and degree of aggregate exposure.
2. Contractor shall use the methods and materials proposed for use on the final installation. Uniformity in appearance of each panel shall be the responsibility of the contractor.
3. Mockups shall be maintained for the duration of the project.

D Review: Project conditions, manufacturer requirements, delivery, and storage, staging and sequencing, and protection of completed work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Solomon Colors, Inc.; 4050 Color Plant Rd., Springfield, IL. 62702;

1. Tel: (800) 624--0261; Website: www.solomoncolors.com
2. Contact: ArchitecturalTeam@SolomonColors.com

B Approved equal.

2.02 MATERIALS

A Concrete Materials: Specified in Section 03 30 00.

1. Aggregate Considerations: Graded and washed aggregate and sand to achieve consistent appearance.
   a. Size/color aggregate to be approved at mockup.
   b. Ratio of sand to aggregate per manufacturer's recommendation to achieve the desired exposure depth and appearance.
   c. Single Source Cements and Aggregates for batch consistency for the entire project.
2. Aggregate to be local Arkansas river rock, or approved equal.

B Colloidal Silica Concrete Surface Treatment: Single component colloidal silica-based admixture for improving surface properties; Reducing efflorescence in colored concrete, improving workability for consistent aggregate exposure, Improving the bond between aggregate and concrete paste for more durable exposed aggregate finishes.

1. Product: Day 1 Surface Technology by Solomon Colors, Inc. www.solomoncolors.com
   a. Material Type: Water-based, colloidal silica blended surfactant
   b. VOC Content: < 50 grams per liter.

c. VOC Emissions: CDPH Standard 1.2 VOC Emissions certified

2. Approved equal.

C Fibrous Reinforcement: Cellulose micro-fiber designed to provide secondary reinforcement. Reduces plastic shrinkage cracking and remains invisible on decorative surfaces.

1. Product: UltraFiber 500 by Solomon Colors, Inc. www.solomoncolors.com
   a. Material: Alkali-resistant natural cellulose fibers.
   b. Meet ASTM A820/A820M, ASTM D7357, and ASTM C1116, Section 4.1.4, Type IV.
   c. Stability: Exceed ICC-ES requirements of 90 percent average Zero-Span Stability Ratio (ZSSR) after exposure to saturated calcium hydroxide and 1.0N sodium hydroxide, tested to ASTM D6942.
2. Approved equal.

D Color Pigment: Iron oxide concrete pigment meeting ASTM C979/C979M; light-fast, insoluble, and alkali resistant, in powdered, liquid, or granular form.

1. Source: Iron Oxide Pigment or Brickform Powdered Integral Color by Solomon Colors, Inc. www.solomoncolors.com, or approved equal.
2. Color: To be selected from manufacturer's full color range.

E Surface Retarder: Water based treatment designed to retard the hydration of top layer of concrete paste, producing an exposed aggregate, or sand finish appearance. Product may be used on both horizontal and vertical surfaces

1. Source: Brickform Select-Etch by Solomon Colors, Inc. www.solomoncolors.com, or approved equal.
2. Exposure depth: 1/8".

Item #	Color	Agg Exposure	Exposure Depth
SE75	Blue	1/8" - 3/8"	1/8" (3.2 mm)

F Curing and Sealing: Curing and sealing products to be determined at time of mockup. Some products or methods may not be compatible with project requirements. Considerations include VOC requirements, desired sheen, color enhancement, and environmental conditions. Refer to Solomon Colors' product data for assistance with selecting the proper curing and sealing product(s).

1. Concrete Curing Compound: Clear, film-forming curing/sealing compound, suitable for decorative concrete. Reference ACI 310R
   a. Water-based.
   b. Product: Brickform Gem Cure and Seal by Solomon Colors, Inc. www.solomoncolors.com, or approved equal.

2. Concrete Surface Sealer: VOC compliant, clear acrylic or penetrating sealer, designed to reduce porosity of exposed aggregate concrete surface.
    a. Water-Based Penetrating Sealer: Natural look with no sheen and no film.
        i. Product: Brickform Stealth Seal WB by Solomon Colors, Inc. www.solomoncolors.com, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

A Apply Materials in accordance with manufacturer's recommendations.

B Methods and materials shall match that of approved mockup production.

3.02 CONCRETE FINISHING

A Follow standard practices and reference Section 03 30 00.

B Exposed Aggregate Finishing

1. Do not use tools that may force the aggregate away from the surface creating a non-uniform surface after exposure.
2. Finish slab surface to be uniform, flat, without low spots or ridges. Do not overwork the surface to be exposed.

3.03 COLLOIDAL SILICA SURFACE TREATMENT INSTALLATION

A After screed and immediately before bull float for concrete performance application.

1. Spray-apply to concrete surface with uniform coverage.
2. Typical Coverage will be appx. 300-500 ft^2/gallon or according to manufacturer's specification.

B At time of troweling and/or hand finishing for finishing aid application.

1. Spray apply as needed to facilitate finishing operations and surface lubrication.
2. Typical coverage will be 800-1000 ft^2/gallon or according to manufacturer's specification.

C Prevent overspray of material to adjacent equipment and construction materials.

3.04 CONCRETE SURFACE RETARDER INSTALLATION

A Protect all adjacent concrete surfaces, pavers, stones, borders, etc. that are not to receive retarder finish prior to concrete placement and retarder application.

B Application:

1. Spray the Concrete Surface Retarder with low-pressure sprayer at a rate of 250-300 ft^2/gallon.
2. Maintain an even continuous application.
3. Once dry, Concrete Surface Retarder must provide a coating that provides intermittent rain protection. Protect the surface if heavy extended rains are predicted or during extremely hot weather to retain moisture and protect the etch retention.

C Removal:

1. Concrete Surface Retarder can be removed when the underlying concrete has sufficiently hardened, typically ranging from 5 to 12 hours after initial placement.
2. Do not exceed 24 hours before removing.
3. Wash surface with running water with a push broom, high pressure washing, or a rotary buffer with bristle attachment and water.
4. Timing and removal should be determined by the project testing and jobsite samples. When using light etches, it is generally better to remove Surface Retarder the same day.
5. Dispose of wash water slurry in accordance with environmental regulations per relevant jurisdictional authority.

3.05 CONCRETE CURING and SEALING COMPOUND INSTALLATION

A Curing Compound:

1. After water from removal has dissipated from the slab, apply curing compound uniformly.
2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

B Sealer:

1. After recommended cure time has been achieved, apply surface sealer.
2. Follow manufacturer's recommendations for coverage, methods, and environmental allowances.

3.06 CONCRETE REPAIR AND PROTECTION

A Repair and patch defective areas using the same materials as the original concrete. Place, finish, and cure to achieve a blended appearance with adjacent concrete.

B Remove and replace damaged areas that do not comply with requirements in this section. Replacement areas should be made between joints or other visible termination point.

C Protect finished concrete from staining, soils, and other foreign material until completion.

D Follow recommended continuing maintenance procedures.

END OF SECTION 03 35 23

SECTION 04 0100
MAINTENANCE OF MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water -based cleaning of existing brick and mortar surfaces.

B. Repointing mortar joints at existing brick walls.

C. Regrouting grout joints at existing brick pavers.

1.02 RELATED REQUIREMENTS

A. Section 04 0511 - Masonry Mortaring and Grouting.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on cleaning compounds.

C. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention, and instructions for use on historic brick masonry substrates.

1.04 QUALITY ASSURANCE

A. Restorer: Company specializing in masonry restoration with minimum three years of documented experience.

1.05 MOCK-UP

A. Provide the following mockups to demonstrate aesthetic effects and workmanship:
   1. Historic Gate Cleaning: Clean an area of existing masonry wall, minimum size 3 ft by 3 ft panel of wall to determine extent of cleaning.
      a. Perform and obtain acceptance of cleaning mockup prior to proceeding with repointing mockup at same location.
   2. Historic Gate Repointing: Repoint an area of existing masonry wall, minimum size 3 feet long by 3 feet high.
   3. Front Porch Regrouting: Regrout an area of existing brick pavers, minimum size 3 feet long by 3 feet wide.

B. Locate mockups where directed.

C. Acceptable panels and procedures employed will become the standard for work of this section.

D. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer’s original and unopened containers, labeled with manufacturer’s name and type of products.

B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

C. All cleaning materials stored and used on the site shall be clearly labeled with proper warning to prevent any accidental use of the products by unauthorized persons. Store cleaning materials and equipment at location approved by Owner.

D. Maintain SDS for cleaning materials with materials in storage area and available for ready reference on project site.

1.07 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Water-based Cleaning Methods:
   1. Perform all prewetting, cleaning and rinsing procedures using hand methods or using pressure washer with the following requirements:
      a. Prewetting, cleaning and rinsing shall be performed at very low water pressures (measured at the tip) not to exceed 50 psi.
      b. Use a stainless steel spray tip with a 45-degree fan spray.
      c. Hold cleaning want minimum 12-inches from the masonry surface, and move want in a continuous motion.
      d. Hot water may be used to improve cleaning effect or rinsing.
   2. DO NOT USE pressurized water cleaning or rinsing above stated pressures or beyond above-prescribed requirements without prior written authorization by Architect.
   3. DO NOT USE sand-blasting or micro-abrasive methods.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS

A. Mild Detergents and Surfactants:
   1. Proctor & Gamble: Orvus WA Paste (gel); dilute 1.0 percent with water.
   2. Picreator Enterprises Ltd.: Vulpex Liquid Soap (gel); dilute 1 part to 6 parts water.
   3. Dow Chemical: Triton X-100 (gel); dilute 3.0 percent with water.
   4. PROSOCO, Inc.: Klean 'n Release Cleaner
   5. PROSOCO, Inc.: Enviro Klean 2010 All Surface Cleaner.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Biocides and Biological Stain Removers:
   1. D/2 Biological Solution, Inc.: D/2 Biological Solution
   2. Substitutions: See Section 01 6000 - Product Requirements.

C. Water for Prewetting, Cleaning and Rinsing:
   1. Clean, potable water.
   2. When hot water is used in cleaning, heat water to a temperature of 120 deg F.

D. Cleaning Accessories: Provide all cleaning tools, materials and accessories to complete the Work as specified and per manufacturer's written instructions. This may include, but may not be limited to, the following:
   1. Applicator sprayers, brushes, rollers, sponges, buckets.
   2. Scrub brushes:
      a. Use natural bristle brushes or plastic brushes. Use brushes that are resistant to chemical cleaners being used.
      b. Do not use wire brushes or metal scrapers.
   3. Protection materials:
      a. Polyethylene sheeting, 4 mil.
      b. Blue painters tape.
      c. Kraft paper.

2.02 MORTAR AND GROUT MATERIALS

A. Comply with requirements of Section 04 0511.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces to be cleaned and restored are ready for work of this section.

3.02 PREPARATION

A. Protection:
   1. Protect surrounding building and site elements from damage due to restoration procedures.

2. Comply with chemical cleaner manufacturer’s written instructions for protecting building and other surfaces against damage from exposure to its products.
3. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
4. Separate areas to be protected from restoration areas using means adequate to prevent damage.
5. Cover existing landscaping with tarpaulins or similar covers.
6. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.

B. Removal of Plant Growth:
1. Completely remove plants, vines, moss, and shrub growth from masonry surfaces using plastic scrapers and similar tools that will not damage brick surface.
2. Carefully remove plants, creepers, and vegetation by cutting at roots. Remove loose soil and debris from open masonry joints.

3.03 CLEANING EXISTING MASONRY

A. Cleaning, General:
1. The purpose of the cleaning process is to remove atmospheric deposits, soil, staining, grease, oil, and other contaminants without damage to, or disintegration of, the masonry surface.
2. The result of the cleaning is not expected to return the substrate to 100 percent clean or a new appearance. The level of cleaning shall be as approved in the mockup.
3. The cleaning system shall not discolor, etch, burn, bleach, streak, or otherwise damage the masonry surface.
4. Proceed with cleaning in an orderly manner; work from top to bottom, and from one end of each cleaning area to the other.
5. Perform each cleaning method indicated in a manner that results in uniform coverage of all surfaces, including corners, moldings, and interstices, and that produces an even effect without streaking or damaging masonry surfaces.

B. Detergent Cleaning:
1. Prewet masonry surface with very low pressure water.
2. Prepare cleaning solution, and dilution if appropriate, per manufacturer's written instructions.
3. Apply cleaning solution as directed by manufacturer and allow to dwell on surface. Dwell times are as recommended by manufacturer, and to be confirmed through mockup.
4. Gently scrub surface with soft brushes to loosen soiling. Keep surface wet by misting with water if necessary; do not allow to dry on substrate.
5. Rinse thoroughly with low pressure water. Agitate with scrub brushes during rinsing to remove soiling.
6. Continue rinsing substrate to remove all cleaning residues and until the pH of the surface has returned to neutral. Confirm with pH test strips.
7. After cleaning is complete, remove all protection materials and allow to completely dry.

3.04 REPOINTING (REGROUTING) MASONRY

A. Mixing of Mortar and Grout: Comply with requirements in Section 04 0501.

B. Rake out and repoint joints to the following extent:
1. All joints in areas indicated on Drawings.
2. Joints where mortar is missing or contains holes.
3. Cracked joints where cracks can be penetrated by a knife blade (0.027-inch thick).
4. Joints that are eroded 1/4-inch beyond the masonry surface.
5. Joints where mortar is deteriorated and can be easily removed by hand.
6. Do not rake out and repoint joints where not required.

C. Rake out joints as follows:

1. Remove mortar or grout from joint to provide reveals with square backs and to expose masonry for contact with pointing mortar.
2. Remove mortar or grout from joints to depth of joint width plus 1/8-inch, but not less than 1/2-inch, or not less than that required to remove all unsound loose mortar.
    a. If unsound mortar extends more than 2-inches from the face of the units, contact Architect for direction. Brick units may require removal and resetting.
3. Do not spall edges of masonry units or widen joints beyond existing dimensions.
4. Use of hand tools/chisels is preferred; angle griders may be used at masonry contractor's discretion provided they do not overcut or otherwise damage masonry units.
    a. When using grinders, cut out center of joint and remove remaining mortar by hand with chisels.
    b. "Half moons" created by grinders in head joints will not be allowed.
5. Following joint removal, remove dirt and loose debris with brush and/or vacuum, and flush joints with water.

D. Repoint joints as follows:
1. Apply pointing mortar first to areas where existing mortar was removed to depths greater than surrounding area (deeper than 1/2-inch). Apply in layers not greater than 1/2-inch until a uniform depth is formed.
2. After deeper areas have been filled, point all joints by placing mortar in layers not greater than 1/4-inch.
3. Fully compact each 1/4-inch layer and allow it to become thumbprint hard before applying next layer.
4. Where existing masonry has worn or rounded edges, slightly recess finished mortar surface from face of masonry to avoid wider joints. Take care not to spread mortar over edges onto exposed masonry surfaces or to featheredge mortar.
5. Wipe excess mortar from masonry with a damp sponge or cloth. Clean mortar splatters and immediately remove excess mortar in contact with exposed masonry and other surfaces.
6. When joints are filled and mortar is thumbprint hard, tool joint profiles to match original appearance of joints. Remove excess mortar from edge of joint by brushing.
7. Cure mortar by maintaining in damp condition for at least 72 hours. Cover with wet burlap or plastic sheeting, and mist with water if required.

3.05 CLEANING AND PROTECTION

A. At the conclusion of work, remove all protection materials and equipment. Clean all debris, refuse and surplus materials, and remove from premises.

B. Protect completed work from damage until Substantial Completion.

END OF SECTION

SECTION 04 0511
MASONRY MORTARING AND GROUTING

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 0120 - Maintenance of Unit Masonry

B. Section 04 2000 - Unit Masonry: Installation of mortar and grout.

C. Section 32 1400 - Unit Paving: For unit paving mortar and grout products.

1.03 REFERENCE STANDARDS

A. ASTM C141/C141M - Standard Specification for Hydrated Hydraulic Lime for Structural Purposes; 2014.

B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

C. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

E. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

F. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

H. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2008).

I. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014.

J. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

D. Samples: Submit two cured samples of each type of mortar, illustrating mortar color.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the job site in manufacturer’s sealed packaging and store unopened until required for use.

B. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

1.06 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Types as scheduled in this section.
   2. Color: Mineral pigments added as required to produce approved color sample.

B. Portland Cement: ASTM C150/C150M.
   1. Type: Types I or II; ASTM C150/C150M.
   2. Color: Color as required to produce approved color sample.

C. Packaged Dry Mortar: ASTM C387/C387M, Type N or S, using gray or white color cement as required to achieve desired mortar color.

D. Hydrated Lime: ASTM C207, Type S.

E. Natural Hydraulic Lime (NHL): ASTM C141/C141M , Type NHL 3.5, for moderate-strength historic masonry.
   1. Manufacturers:
      a. Lancaster Lime Works Natural Hydraulic Lime; www.lancasterlimeworks.com.
      b. Saint-Astier Natural Hydraulic Lime; www.limeworks.us.
      c. Substitutions: See Section 01 6000 - Product Requirements.

F. Mortar Aggregate: ASTM C144; clean, sharp, well-graded mason's sand.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
      a. White-Mortar Aggregates: Natural white sand or crushed white stone.
      b. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
   2. For joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve
   3. Sand shall contain no more than 50 parts per million of chloride ions. Sand shall be free of organic contaminants.

G. Grout Aggregate: ASTM C404.

H. Water: Clean and potable. Free from deleterious amounts of acids, alkalis or organic materials.

I. Admixtures:
   1. No admixtures shall be used without written approval, unless otherwise specified.
   2. No calcium chloride or admixtures containing calcium chloride shall be used in the mortar.
   3. No air-entraining admixtures or material containing air-entraining admixtures shall be used in the mortar.

2.03 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.
   3. Exterior, non-loadbearing masonry: Type N.
   4. Exterior, masonry veneer: Type N.

5. Historic Exterior Masonry Pointing Mortar: Type NHL 3.5
    a. Mix Ratio: 1 part NHL 3.5 to 2.5 to 3 parts sand by volume, adjusted for proper workability without excess water.
6. Exterior, brick pavers: See Section 32 1400 - Unit Paving.

2.04 MORTAR MIXING

A. Thoroughly mix mortar ingredients in accordance with ASTM C270 and in quantities needed for immediate use.

B. Control batching procedure to insure proper proportions by measuring materials by volume with known volume containers. Do not measure mortar materials by shovels.

C. Maintain sand uniformly damp immediately before the mixing process.

D. Do not use anti-freeze compounds to lower the freezing point of mortar.

E. If water is lost by evaporation, re-temper only within two hours of mixing.

PART 3 EXECUTION

3.01 PREPARATION

A. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

B. Perform practices for cold or hot weather requirements.

3.02 INSTALLATION

A. Install mortar to requirements of section(s) in which masonry is specified, and in accordance with BIA Standards.

B. If mortar begins to stiffen, it may be retempered.

C. Use mortar within 2-1/2 hours of initial mixing. Discard mortar not placed within 2-1/2 hours after water is first added to the batch.

3.03 CLEANING

A. At the conclusion of masonry Work remove all equipment and surplus material used for mixing mortar, clean up all debris and refuse and remove same from the site.

END OF SECTION

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Concrete block.

B. Clay facing brick.

C. Reinforcement and anchorage.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing: Reinforcing steel for grouted masonry.

B. Section 04 0511 - Masonry Mortaring and Grouting.

C. Section 05 5000 - Metal Fabrications and Miscellaneous Metals: Loose steel lintels.

D. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

E. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

F. Section 32 3219 - Garden Wall: For brick veneer.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2011.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2018.

G. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2014.

H. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2011.

I. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2026a.

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2026a.

K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

L. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

M. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.

N. BIA Technical Notes No. 28B - Brick Veneer/Cold-Formed Steel Framed Walls; 2025.

O. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

P. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UPS

A. Provide the following mockups to demonstrate aesthetic effects and workmanship:
   1. Garden Room Veneer Masonry Base: Construct a portion of the masonry wall as a mock-up panel, minimum size one structural bay (column to column). Include mortar, accessories, structural backup, flashings (with lap joint, corner, and end dam), and final cleaning.
   2. Greenhouse Veneer Masonry Knee Wall: Construct a portion of the masonry wall as a mock-up panel, minimum size one structural bay (column to column). Include mortar, accessories, structural backup, flashings (with lap joint, corner, and end dam), and final cleaning. Coordinate with Section 13 3413.13 - Greenhouses.

B. Locate mockups where directed.

C. Mock-up may remain as part of the Work if approved by Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry materials by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners.
   3. Load-Bearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
   4. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.

2.02 BRICK UNITS

A. Manufacturers:
   1. Gavin Historical Bricks: Antique Iowa Brick; info@historicalbricks.com..
   2. Substitutions: See section 01 6000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBS Smooth, Grade SW.
   1. Color and texture: Antique Iowa Brick blend.
   2. Nominal size: As indicated on drawings.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 0511.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com.
   2. Hohmann & Barnard, Inc; www.h-b.com/#sle.
   3. WIRE-BONDwww.wirebond.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi), deformed billet bars; galvanized.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss or ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

E. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

F. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss, with adjustable ties or tabs spaced at 16 in on center.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
   3. Size: 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inchwire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.

G. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Concrete or CMU backing: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dipped galvanized to ASTM A 153/A 153M, Class B, installed in recessed dovetail slot or surface mounted to face of wall.
   2. Steel or Wood Stud backing: 2 piece anchor designed for use with continuous insulation and contains gasketting for sealing at weather barrier penetration.
      a. Manufacturers:
         1) Hohmann and Barnard: 2-seal or approved equal. www.h-b.com.
         2) Rodenhouse: Pos-i-tie Veneer Anchoring System. Thermal Grip Brick Tie Washer. www.rodenhouse-inc.com
         3) Heckmann Building Products: Pos-i-tie Veneer Anchoring System. www.heckmannbuildingprods.com
      b. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
      c. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.
      d. Vertical adjustment: Not less than 2 inches.
      e. Seismic Feature: Provide lip, hook, or clip on end of wire ties to engage or enclose not less than one continuous horizontal joint reinforcement wire of 0.1483 inch

diameter. Provide when project is located in Seismic Zone D or per Structural Plans indicate.

2.05 FLASHINGS

A. Metal Flashing Materials: Copper, as specified in Section 07 6200.

2.06 ACCESSORIES

A. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
         2) CavClear/Archovations, Inc: www.cavclear.com.
         3) Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps:
   1. Type: Polyester mesh.

C. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

D. Steel Loose Lintels: Steel, hot dipped galvanized. See Division 05.

E. Sand; white or tan for use on masonry joint sealants.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Protect all substrates from damage during placement of masonry. Repair any damage caused to substrate prior to concealing with masonry.

C. Coordinate installation requirements of this section of load-bearing and non-load bearing CMU walls with Structural drawings. The more stringent instruction of the two takes precedent.

D. Coordinate the installation in of any recessed items in masonry walls with other trades. Do not conceal work of other trades prior to their completion.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls, minimum of two weeps per opening.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents. Mortar diverter to be installed in full depth of masonry air cavity.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall or masonry type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 16 inches horizontally and 16 inches vertically.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

C. Masonry Veneer Anchors through Weather Barrier / Insulation:
   1. Installation before weather barrier: Ensure perimeter of anchors are smooth and consistent as required by weather barrier manufacturer.
   2. Installation after weather barrier: Install as to not damage weather barrier. Patch any damage on the exterior with plastic flashing or sealant and patch holes on interior with sealant.
   3. Installation after weather barrier / rigid insulation: Install as to not damage weather barrier concealed behind rigid insulation board. Patch any holes or damage done to weather barrier from the exterior by removing rigid insulation and repairing with plastic flashing. Patch holes through weather barrier and sheathing from interior with sealant.

D. Seismic Reinforcement: Connect veneer anchors with continuous horizontal wire reinforcement before embedding anchors in mortar.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 4 inches into adjacent masonry or turn up at least 4 inches to form watertight pan at non-masonry construction. Ends of flashing to contain premanufactured or field folded water tight end dams.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.
   4. Install flashing at rowlock water table sills, masonry and/or stone caps, pedestals, etc where masonry is exposed to above whether indicated on plan or not. Grout masonry solid at said locations.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Anchor vertical leg of flashing into backing with a termination bar and sealant. Space fasteners for termination bar at no more than 12 inches on center and into solid blocking.

C. Extend metal flashings to within 1/4 inch of exterior face of masonry. Flashing should not be visible from the exterior.

D. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

D. Size control joint in accordance with Section 07 9005 for sealant performance.

E. Form expansion joint as detailed on drawings.

F. Space masonry control joints at intervals no more than 20 feet apart horizontally and vertically and as indicated on drawings.

3.12 BUILT-IN WORK

A. As work progresses, install built-in items furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.15 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000. Coordinate test requirements with Structural Special Inspection per structural and ICC.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.16 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution. Clean faces of masonry no longer than 2 weeks from installation. Inadequate cleaning is considered defective work.

D. Use non-metallic tools in cleaning operations.

E. Stain surface of mortar where discoloration appears from field tone/color. Coordinate locations requiring staining with architect.

3.17 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

B. Related Sections:
   1. Section 05 3100 "Steel Decking".
   2. Section 05 5000 "Metal Fabrications and Miscellaneous Metals" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.

1.03 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.04 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using AISC “Manual of Steel Construction.”
   2. Use ASD; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

1.05 ACTION SUBMITTALS: Comply with Division 01.

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

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. Identify members and connections of the seismic-load-resisting system.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer fabricator and testing agency.

B. Welding certificates for all welders employed on this Project.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength bolt-nut-washer assemblies.

4. Shear stud connectors.
5. Shop primers.
6. Nonshrink grout.

F. Source quality-control reports.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: The fabricator must show evidence of successful completion of five projects of similar size and scope within the previous five (5) years. The fabricator must have an ongoing, written quality assurance program, functioning and in place at least one (1) year prior to the submission of bids for this project.

B. Installer Qualifications: Installer must show evidence of successful completion of five projects of similar size and scope within the previous five (5) years. The erector must have an ongoing, written quality assurance program, functioning and in place at least one year prior to the submission of bids for this project.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1, P2, P3, or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
5. AISC 346.
6. AISC's "Specification for Allowable Stress Design of Single Angle Members."
7. AWS D1.1/D1.1M "Structural Welding Code-Steel."

1.08 DELIVERY, STORAGE, AND HANDLING

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

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners for retesting fasteners and lubrication.

1.09 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

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

C. Coordinate work with other trades, including mechanical, electrical, plumbing, and fire protection.

PART 2 PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 60 percent. Documentation to be provided to verify the amount of recycled steel used for this project.

B. Provide products which are extracted, harvested or recovered, and manufactured within 500 miles of project site.

C. W-Shapes: ASTM A 992/A 992M Grade 50.

D. Channels, Angles, M and, S-Shapes: ASTM A 36/A 36M.

E. Plate and Bar: ASTM A 36/A 36M or as indicated on the drawings.

F. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
   1. Weight Class: as indicated on drawings.
   2. Finish: Black except where indicated to be galvanized.

H. Welding Electrodes: E70xx. Comply with AWS requirements, 70 ksi minimum yield, unless noted otherwise.

2.02 BOLTS, CONNECTORS, AND ANCHORS

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

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of A 325 TC steel structural bolts with splined ends, A194 2-H heavy-hex carbon-steel nuts, and F 436 hardened carbon-steel washers.
   1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

E. Unheaded Anchor Rods: F307 or as indicated on drawings.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A 36/A 36M carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain.

F. Headed Anchor Rods: ASTM F 1554, Grade 36 or as indicated on drawings .
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A 36/A 36M carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Plain.

G. Threaded Rods: ASTM A 36/A 36M.
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Washers: ASTM F 436 hardened carbon steel.

3. Finish: Plain.

H. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

I. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

J. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.03 PRIMER

A. Shop Paint/Primer: Alkyd type, lead and chromate free, nonasphaltic, rust-inhibiting, and compatible with topcoat; Tnemec 10-99 Series, or approved equal, and passing ASTM B 117 after 500 hours with no blistering, cracking, softening, delaminating, or rusting at edges. Submit “approved equal” for review and approval.

B. Galvanizing Repair Paint: ASTM A 780 and passing ASTM B 117 after 500 hours of no blistering, cracking, softening, delamination, or rust creepage at scribe and rusting at edges.

2.04 GROUT

A. Nonmetallic, Non-Shrink Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, nongaseous, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time. Provide grout specifically recommended by manufacturer for interior and exterior applications. BASF (Master Builders) “Masterflow 713 Plus,” Euclid “NS Grout,” W.R. Meadows “Sealtight 588 Grout,” or SpecChem “Chem Grout MB.”

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
   4. Mark and match-mark materials for field assembly.
   5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning, SSPC-SP 2, "Hand Tool Cleaning, and SSPC-SP 3, "Power Tool Cleaning as required."

F. 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.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.06 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 or tension control bolt system unless noted otherwise on drawings.

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. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.
   2. Grind flush and smooth.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 1, "Solvent Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 2.0 mils.

2.08 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize exterior structural steel including lintels shelf angles and welded door frames attached to structural-steel frame and located in exterior walls and as indicated on drawings.

2.09 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected 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 will not be accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.03 ERECTION

A. Brace and guy members until final connections are made; structure is not stable until all members, connections, bracing, decking, and other structural components are in place and secured. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Setting Bases and Bearing 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. Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. 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.

3.04 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 or Tension Control Bolt System unless noted otherwise on drawings.

B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
   4. Verify the weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel with limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
      a. Grind butt welds flush.
      b. Grind or fill exposed fillet welds to smooth profile.
      c. Dress exposed welds.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections. Contractor shall facilitate access and coordination of inspections. Contractor is responsible for providing adequate control personnel to ensure proper compliance with contact documents.

B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts." Test and continually inspect a minimum of 10 percent of bolts and all bolted connections at the seismic-load-resisting system.

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected 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 will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.
   2. Test and continually inspect a minimum of 10 percent of welds and all welded connections at the seismic-load-resisting system.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Waste Management: Separate and recycle waste in accordance with Waste Management Plan.

END OF SECTION

SECTION 05 3100
STEEL DECKING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Roof deck
   2. Non-composite form deck
   3. Composite deck

B. Related Requirements:
   1. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.03 ACTION SUBMITTALS: Comply with Division 01

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Quality procedures and personnel according to AWS D1.3, “Structural Welding Code – Sheet Steel.”

C. Electrical Raceway Units: Provide UL-labeled cellular floor-deck units complying with UL 209 and listed in UL's "Electrical Construction Equipment Directory" for use with standard header ducts and outlets for electrical distribution systems.

D. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

E. AISI "Specifications for the Design of Cold-Formed Steel Structural Members.”

F. SDI "Design Manual for Composite Decks, Form Decks and Roof Decks.”

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

C. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

D. Provide products which are extracted, harvested or recovered, and manufactured within 500 miles of project site.

2.02 ROOF DECK

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. Canam United States; Canam Group Inc.
   2. CMC Joist & Deck.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Epic Metals Corporation.
   5. New Millennium Building Systems, LLC.
   6. Nucor Corp.; Vulcraft Group.
   7. Valley Joist; Subsidiary of EBSCO Industries, Inc.
   8. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), G60 zinc coating.
   2. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer's standard or as indicated on the Construction Documents.
   3. Deck Profile: As indicated.
   4. Profile Depth: As indicated.
   5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
   6. Span Condition: As indicated.
   7. Side Laps: As indicated.

2.03 NONCOMPOSITE FORM DECK

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. Canam United States; Canam Group Inc.
   2. CMC Joist & Deck.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. New Millennium Building Systems, LLC.
   5. Nucor Corp.; Vulcraft Group.
   6. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Non-composite Form Deck: Fabricate ribbed-steel sheet non-composite form-deck panels to comply with "SDI Specifications and Commentary for Non-composite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Uncoated Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 minimum.

2. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 minimum, with top and underside surface shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
3. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating.
4. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard baked-on, rust-inhibitive primer.
   a. Color: Manufacturer's standard.
5. Profile Depth: As indicated.
6. Design Uncoated-Steel Thickness: As indicated.
7. Span Condition: As indicated.
8. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.04 COMPOSITE FLOOR DECK

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. Canam United States; Canam Group Inc.
   2. CMC Joist & Deck.
   3. Consolidated Systems, Inc.; Metal Dek Group.
   4. Epic Metals Corporation.
   5. New Millennium Building Systems, LLC.
   6. Nucor Corp.; Vulcraft Group.
   7. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Composite Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 minimum, with top surface phosphatized and unpainted and underside surface shop primed with manufacturers' standard gray baked-on, rust-inhibitive primer.
   2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating.
   3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G60 zinc coating; with unpainted top surface and cleaned and pretreated bottom surface primed with manufacturer's standard gray baked-on, rust-inhibitive primer.
   4. Profile Depth: As indicated.
   5. Design Uncoated-Steel Thickness: As indicated.
   6. Span Condition: As indicated.

2.05 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598-inch-thick, with factory-punched hole of 3/8-inch minimum diameter.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

K. Shear Connectors: Headed stud type, ASTM A 108, Grade 1015 or 1020, old-finished carbon steel, with dimensions complying with AISC specifications.

PART 3 EXECUTION

3.01 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, except maximum spacing of welds shall not exceed 6" o.c., edge (boundary) welds shall not exceed 6" o.c., and at spans greater than 5 feet, fasten side laps together at maximum 36" o.c., unless otherwise indicated.

3.03 FIELD QUALITY CONTROL

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

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.04 PROTECTION

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

B. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09, "Painting and Coating”.

C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 5000
METAL FABRICATIONS AND MISCELLANEOUS METALS

PART 1 GENERAL

1.01 SUMMARY: Metal fabrications and miscellaneous metal work, complete, including:

A. Railings, handrails.

B. Steel pipe bollards.

C. Miscellaneous metal steel attachments, anchors, plates, angles, etc.

D. Anchors angles, bolts, expansion shields for items in this section only, and other accessories shown in details and or required for the complete installation of all work.

E. Gratings.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Cast-In-Place Concrete; Section 03 3000.

B. Concrete Unit Masonry; Section 04 2200.

1.03 SUBMITTALS: Comply with Division 01.

A. Product Data: Submit for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings: Submit shop drawings for the fabrication and erection of all assemblies of metal fabrications and miscellaneous metal work. Include plans, elevations, sections, and details of fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1.04 PROJECT CONDITIONS

A. Field Measurements:

1. Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.
2. Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of products without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to guaranteed dimensions. Allow for trimming and fitting.

PART 2 PRODUCTS

2.01 MATERIALS

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

2.02 FERROUS METALS

A. Steel Plates, Rods, Tubes, Bars and Shapes: ASTM A 36.

B. Steel Pipe: ASTM A 53 black finish steel pipe, standard weight Schedule 40.

C. Steel Bars for Bar Gratings: ASTM A36 or steel strip ASTM A 101 or ASTM A 1018.

2.03 FASTENERS

A. General: Type 304 or 316 stainless steel fasteners for exterior use and zinc plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless steel fasteners for fastening aluminum. Select fasteners for type, grade, class required.

B. Steel Bolts and Nuts: Regular hexagon head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1 (A1).

D. Eyebolts: ASTM A 489.

E. Machine Screws: ASME B18.6.3.

F. Lag Bolts: ASME B18.2.1.

G. Toggle Bolts: Tumble-wing type F.S. FF-B-588 type, class and style as required.

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1

J. Lock Washers: Helical, spring type, ASME B18.21.1.

K. Expansion Shields: F.S. FF-S-325

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

M. Expansion Bolts Wedge Anchors: Ramset "Trubolt" or Hilti "Kwik Bolt".

N. Adhesive Anchors: Hilti "HIT HY150", injection adhesive anchor.

O. Anchor Bolts: ASTM F 1554, Grade 36 and Grade 55 as indicated on the drawings. Furnish and deliver to site, anchor bolts and other items to be embedded in concrete. Provide necessary shop details and diagrams for concrete forms and, if required, provide templates to insure proper and accurate locations and setting of anchor bolts.

P. Clips and anchorage devices for gratings. Provide no fewer than four saddle clips fore each grating section containing rectangular bearing bars 3/16 inch or less in thickness and spaced 15/16 inch or more o.c., with each clip designed and fabricated to fit over two bearing bars.

2.04 FABRICATED ITEMS

A. Vanity Supports: Rakks EHV-Vanity Support Brackets: www.rakks.com; phone 800-826-6006.
   1. Provide standard support brackets at 2’-8” o.c. unless shown otherwise.
   2. Finish: Natural anodized aluminum.

2.05 WELDING RODS AND ELECTRODES:

A. Select in accordance with AWS specifications for metal alloy to be welded.

2.06 MISCELLANEOUS ITEMS:

A. Furnish bent or otherwise custom fabricated angles, bolts, plates, z-clips, anchors, hangers, dowels and other miscellaneous steel shapes as required for framing and supporting work and for anchoring or securing work to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Section 06 1000.

2.07 PAINT

A. Shop Paint: Lead free, alkyd primer; Tnemec 10-99, or approved equal, meeting performance requirements of F.S. TT-P-86, and passing ASTM B 117 after 500 hours. Primer selected must be compatible with finish coats of paint. Coordinate selection of metal primer with finish paint requirements specified in Section 09 9100.
   1. VOC Content less than 200 g/L; EQ 4.2.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel work, complying with SSPC- Paint 20.
   1. VOC Content less than 250 g/L; Credit EQ 4.2.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.08 GALVANIZING:

A. Apply zinc coating by hot-dip process to structural steel according to ASTM A 123. Fill vent holes and grind smooth after galvanizing.

B. Apply to exposed miscellaneous metal at exterior and as indicated on drawings.

2.09 NON-SHRINK NONMETALLIC GROUT:

A. Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacture for interior and exterior applications. BASF (Master Builders) "Masterflow 713", Euclid "Euco N.S. Grout", or W. R. Meadows "Sealtight 588 Grout".

2.10 FABRICATION, GENERAL

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

B. Workmanship: Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

C. Cut, drill and punch metals cleanly and accurately. Remove burrs and ease exposed edges to a radius of approximately 1/32" unless otherwise shown.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

F. Weld corners and seams continuously, complying with AWS recommendations.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cut, reinforce, drill and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

K. Shop Painting:
   1. Shop paint miscellaneous metal work, except concealed metal work, members or portion of members to be embedded in concrete or masonry, surfaces and edges to be field welded, anodized aluminum, and galvanized surfaces, unless otherwise specified.
   2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC SP-3.
   3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.

4. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

2.11 FABRICATION, GENERAL

A. Workmanship: Use materials of size and thickness shown or, if not shown, of required size and thickness to produce strength and durability in finished product. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use type of materials shown or specified for various components of work.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type shown or, if not shown, Phillips flat-head (countersunk) screws or bolts. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use. Cut reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

E. Shop Painting:
   1. Shop paint miscellaneous metal work, except concealed metal work, members or portion of members to be embedded in concrete or masonry, surfaces and edges to be field welded, anodized aluminum, and galvanized surfaces, unless otherwise specified.
   2. Remove scale, rust and other deleterious materials before applying shop coat. Clean off heavy rust and loose mill scale in accordance with SSPC SP-2 or SSPC SP-3.
   3. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
   4. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.

2.12 MISCELLANEOUS METAL FABRICATIONS

A. Handrails, Railings and Brackets: Refer to details.
   1. Fabricate to comply with requirements indicated for design, dimensions, details, finish, member sizes and anchorage, but not less than that required to support structural loads.
   2. Assemble 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. Use connections that maintain structural value of joined pieces.
   3. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32", unless otherwise indicated. Remove sharp and rough areas on exposed surfaces.
   4. Form work true to line and level with accurate angles and surfaces.
   5. Cut, reinforce, drill and tap to receive hardware, screws, and similar items.
   6. Welded Connections: Cope components at connections to provide a close fit, or use fittings designed for this purpose. Weld all around at connections, including fittings.
   7. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   8. Form changes in direction by insertion of prefabricated elbow fittings, by radius bends, by mitering at elbow bends, or by bending.
   9. Close exposed ends of handrail members with prefabricated ends.

10. Prime as specified in this section.

B. Bollards: 6” diameter steel pipe in concrete footing filled with concrete, rounded at top. Concrete is specified in Section 03 3000.

C. Ladders: Steel bars and rods, and shapes in sizes and designs indicated.

D. Steel Supports: Provide structural steel lintels, channels, braces, angles, etc., as indicated and assemble as detailed. Secure all connections to provide rigid supports for all items required including supports not specifically specified in other sections.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.02 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, Placement: Perform cutting, drilling and fitting required for installation. Set metal fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true, and free of rack; measured from established lines and levels.

C. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

D. Setting Loose Plates:
   1. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom of surface of bearing plates.
   2. Set loose leveling and bearing plates on wedges, or other adjustable devices. 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 grout.

E. Handrails, Railings, Gates: As detailed. Set in concrete in non-corrosive pipe sleeves with non-shrink grout or anchor to supports as indicated or required by project conditions. Secure handrails to wall with wall brackets and end fittings.

F. Interior Ladders: Securely anchor to walls as indicated.

3.03 TOUCH-UP SHOP PAINTING:

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Use galvanizing repair paint on damaged galvanized surfaces.

END OF SECTION

SECTION 05 5100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

B. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

C. Section 05 5213 - Pipe and Tube Railings: Metal handrails for the stairs specified in this section.

D. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AISC 207 - Standard for Certification Programs; 2025.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

D. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

F. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

H. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.

I. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State of Arkansas, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

C. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 207.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft and a concentrated load of 300 lb with deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Railing Assemblies: Comply with ASTM E985.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Open.

C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
   5. Concrete Finish: Steel troweled.

D. Stringers: Rolled steel channels.
   1. Stringer Depth: 10 inches.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

E. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: As specified in Section 05 5213.

B. Guards: Pipe railings as specified in Section 05 5213.

2.04 MATERIALS

A. Steel Sections: ASTM A 36/A 36M.

B. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
   1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
   2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
   1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
   2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 5213
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 05 5100 - Metal Stairs: Attachment plates for handrails specified in this section.

B. Section 09 9113 - Exterior Painting: Paint finish.

C. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

D. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

E. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State of Arkansas, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.

C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

D. Exposed Fasteners: No exposed bolts or screws.

E. Straight Splice Connectors: Steel concealed spigots.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 7000
DECORATIVE METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal units.

B. Railing and Guardrail assemblies

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

C. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

E. ASTM B138/B138M - Standard Specification for Manganese Bronze Rod, Bar, and Shapes; 2011.

F. ASTM B248 - Standard Specification for General Requirements for Wrought Copper and Copper Alloy Plate, Sheet, Strip, and Rolled Bar; 2012.

G. ASTM B248M - Standard Specification for General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strip, and Rolled Bar (Metric); 2012.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, anchors, and accessories.

C. Shop Drawings: Indicate elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

D. Samples for initial selection: for products involving selection of color, texture, or design, including mechanical finishes

E. Test Reports: Submit test reports from independent testing agency showing compliance with specified design and performance requirements.

F. Manufacturer's Instructions: Indicate installation.

G. Installer's qualification statement.

H. Maintenance Data: Manufacturer's instructions for care and cleaning.

I. Executed warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

B. Installer Qualifications:
   1. Installer specialized in work of type specified with at least three years of documented experience and approved by manufacturer.

C. Templates: Supply installation templates, reinforcing, and required anchorage devices.

1.05 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Mockups: Build mockups to verify slections made under Sample submittals, to demonstrate aesthetic efffects, and to set quality standards for fabrication and installation.
   1. Build mockups for each form and finish railing, consisting of two posts, top rail, infill area, and anchorage system components that are full height and are not less than 24 inches in length
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in factory-provided protective coverings and packaging.

B. Protect materials against damage during transit, delivery, storage, and installation at site.

C. Inspect materials for damage upon delivery. Replace damaged and unrepairable materials. Ensure replacement materials are indistinguishable from undamaged parts and finishes.

D. Prior to installation, store materials and components under cover in a dry location.

1.07 WARRANTY

A. Manufacturer Warranty: Provide 2-year manufacturer warranty for defects in materials, fabrication, finishes, and installation. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 DECORATIVE METAL UNITS

2.02 HAND RAIL ASSEMBLIES

A. Decorative Metal Railings:
   1. Manufacturer: Julius Blum
   2. Product: Carlstadt Self-Aligning Wall Bracket; Profile 843.

2.03 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   3. Iron Castings: ASTM A47/A47M, malleable.
   4. Sheet Thickness: 11 gauge, 0.120 inch.
   5. Welding Materials: Comply with AWS D1.1/D1.1M.

C. Bronze Components: ASTM B138/B138M.
   1. Concealed: Alloy 280 muntz metal; color similar to alloy 385.
   2. Exposed: Architectural extruded bronze; color similar to alloy 280.
   3. Sheet Thickness: 12 gauge, 0.081 inch.

D. Brass Components:
   1. Sheet: ASTM B248 or ASTM B248M, No.26 Yellow Brass.
   2. Sheet Thickness: 12 gauge, 0.081 inch.

2.04 FABRICATION

A. Fit and shop assemble items in largest practical sections for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

E. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less tha that required to support structural loads.

F. Shop assemble railings to greatest extend possible to minimize field splicing and assembly. Diassemble units only as necessary for shipping and handling limitations.

G. Welded Connections: Cope components at connections to provide close fit, or use fitting designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develope strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation from Plane: 1/16 inch in 48 inches.

2.06 FINISHES

A. General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication unless otherwise indicated.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Brass Finish: US4 - Dull Brass.
   1. Protective Coating: Lemon oil seal.

C. Steel Finishes:
   1. Baked-Enamel Finish: Manufacturer's standard two-coat baked-enamel finish; topcoat minimum dry film thickness of 1 mil, 0.01 inch. Total minimum dry film thickness of 2 mils, 0.02 inch.
   2. Color: As selected by Architect from manufacturer's standard range.

2.07 ACCESSORIES

A. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure. Ensure attachment devices are of same material as components unless indicated otherwise.
   1. Exposed Fasteners: Not allowed.

2.08 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the State of Arkansas to design railings, including attachment to building construction.

B. Structural Performance: Railings, include attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Unifoprm load of 50lb/ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

3.02 PREPARATION

A. Protect existing work.

B. Clean surfaces to receive units. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove protective film from exposed metal surfaces.

C. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.05 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

C. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 06 0300
CONSERVATION TREATMENT FOR PERIOD WOOD

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rehabilitation and repair of existing exterior architectural woodwork, such as eaves, and at areas specified on Drawings.

B. Work includes, but is not limited to, the following:
   1. Repair of splits, checks, spalls and losses using wood filler.
   2. In-kind replacement of damaged or deteriorated wood components.
   3. Wood dutchman repair.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

1.03 DEFINITIONS

A. Consolidant: Chemical product to strengthen loose or deteriorated wood.

B. Dutchman: Wood patch or fill that replaces damaged or missing area of any wood object. The procedure involves removing symmetrical squared area around defect and replacing it with new wood of same species.

C. In situ: Repair procedure in which wood elements and components remain in place and are repaired without removal from the system they are a part of.

D. New Elements: New, nonhistoric materials added to wood structures to aid in resistance to structural loads or water infiltration.

E. Patch: Use of substitute repair (fill) materials to treat damaged or deteriorated components in situ.

F. Surface Treatment: Application of traditional materials or contemporary chemical products to the surface of wood components to provide protection and reduce water infiltration.

1.04 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. NELMA (SGR) - Standard Grading Rules for Northeastern Lumber; 2013.

D. NLGA (SGRNL) - Standard Grading Rules for Canadian Lumber; 2014.

E. RIS (GR) - Standard Specifications for Grades of California Redwood Lumber; 2000.

F. SPIB (GR) - Grading Rules; 2014.

G. WCLIB (GR) - Standard Grading Rules for West Coast Lumber No. 17; 2004, and supplements.

H. WWPA G-5 - Western Lumber Grading Rules; 2011.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each type of product indicated.

C. Samples: Submit one sample minimum of each type of replacement units to show matching size, profile, and finish.

D. Manufacturer's Instructions: For patching materials, indicate special procedures and conditions requiring special attention.

1.06 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Restore portion(s) of existing exterior architectural woodwork, such as at existing building gable, rake or eave. Include trim, accessories, and flashings.
   1. Removal and Replacement: Remove deteriorated framing members and trim and replace with sound wood to match. Demonstrate proposed restoration techniques and sequencing.
      a. New Wood Elements: Install minimum one of each type indicating installation method and finished appearance.
   2. In-Situ Repair:
      a. Wood Fill (Patching): Apply repair material on two areas, minimum, of wood components of type to be repaired.
      b. Dutchman: Provide dutchman repairs in minimum two locations including one that is only cut and prepared for application. Indicate wood inserts and techniques. Do not proceed with other dutchman repairs until technique has been approved by Architect.

C. Locate mock-up area(s) where directed.

D. Approved restoration mock-up areas, including results of procedures employed, will remain and become the quality standard for work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Protect wood elements during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

C. Deliver manufactured products to job site in their original, unopened containers and packaging with all labels intact and legible at time of use. Delivered materials shall be identical to approve samples.

D. Store packaged materials in clean, dry, well-ventilated areas, away from heat, sparks, flame, direct rays of sun, and intrusion of foreign matter secure area acceptable to Architect. Store materials on raised platforms and under ventilated, waterproof cover. Maintain storage areas free from fire hazard. Immediately re-seal containers after partial use

1.08 FIELD CONDITIONS

A. Perform work only when temperature of products being used, temperatures of existing and new materials, and air temperature and humidity comply with manufacturer's requirements and requirements of this Section. In case of conflict, most stringent requirements shall govern.
   1. Do not proceed with wood epoxy applications until substrate moisture content is within range specified by epoxy manufacturer.

B. Provide temporary facilities and protection as necessary to establish and maintain these conditions, so as not to delay project.

PART 2 PRODUCTS

2.01 REPLACEMENT ROUGH CARPENTRY MATERIALS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Stud Framing, 2 by 2 through 2 by 6:
   1. Species: Allowed under referenced grading rules.
   2. Grade: No.2.

D. Joist, Rafter, and Small Beam Framing, 2 by 6 through 4 by 16:
   1. Species: Allowed under grading rules.
   2. Grade: No.2.

E. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No.2 or Standard Grade.
2. Boards: Standard or No.3.

F. Wood fabricated from old growth timber is not permitted.

2.02 REPLACEMENT FINISH CARPENTRY MATERIALS

A. Wood or Wood-Based Materials:
1. Wood fabricated from old growth timber is not permitted.

B. Exterior Finish Lumber Materials:
1. Softwood Lumber:
a. Western Red Cedar species, quartersawn or rift- sawn, maximum moisture content of 6 percent; with vertical grain.
b. Bald Cypress species (Heartwood only), quartersawn or rift- sawn, maximum moisture content of 6 percent; with vertical grain.
c. Grading: In accordance with rules certified by ALSC; www.alsc.org.

C. Quality Standard: Items fabricated in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 12, unless noted otherwise.

D. Exterior Finish Carpentry Items: Matching existing elements.
1. Window Casings and Moldings: Prepare for opaque finish.
2. Exterior Trim: Prepare for opaque finish.
3. Cornices: Prepare for opaque finish.
4. Soffits and Fascias: Prepare for opaque finish.
5. Balustrades and Handrails: Prepare for opaque finish.
6. Pediments: Prepare for opaque finish.

2.03 WOOD REPAIR MATERIALS

A. Source Limitations: Obtain compatible consolidants and patching and filling compounds from single manufacturer.

B. Patching and Filling Compounds:
1. Epoxy Based: Two-part, adhesive system designed to fill voids in wood and be painted, stained, sawed, nailed, planed, sanded carved, and machined like wood.
a. Formulation: Two-part; resin putty and hardener putty blend, capable of being mixed by hand.
b. Mix Ratio: Recommended by manufacturer.
c. Tensile Strength: 7,500 psi, minimum.
d. Flexural Strength: 16,000 psi, minimum.
e. Compressive Strength: 12,000 psi, minimum.
f. Products:
1) Abatron; WoodEpox: www.abatron.com.
2) Advanced Repair Technology, Inc.: Epoxy Repair System, www.advancedrepair.com.
3) Substitutions: See Section 01 6000 - Product Requirements.

2.04 BONDING ADHESIVES

A. General: Products for repairing and bonding wood and wood-based materials for Dutchman repairs.

B. Adhesive: For exterior exposure, with minimum 15- to 14-minute cure at 70 degree F (21 degree C), in gunnable and liquid formulations as recommended in writing by adhesive manufacturer for each repair type.
1. Titebond III Exterior Ultimate Wood Glue, as manufactured by Franklin International.
2. Or approved equal.

2.05 FIELD FINISHING MATERIALS

A. Wood Primers and Exterior Paints: See Section 09 9113 - Exterior Painting.

2.06 FASTENERS

A. General: Use fastener metals that are non-corrosive and compatible with each material joined. Comply with the following:
   1. Use concealed fasteners for interconnecting wood components.
   2. Use concealed fasteners for attaching items to other work unless exposed fasteners are existing fastening method.
   3. For fastening metals, use fasteners of same basic metal as fastened metal unless otherwise indicated.
   4. For exposed fasteners, use machine screws of head profile flush with metal surface unless otherwise indicated.
   5. Finish exposed fasteners to match finish of metal fastened unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are satisfactory for repair and restoration of architectural woodwork. If unsatisfactory conditions exist, do not commence Work until such conditions have been corrected.

B. Verify that surfaces to be restored are ready for work of this section.

3.02 PREPARATION

A. Protect surrounding elements from damage that may result due to performance of restoration procedures.

B. Remove and store removable items located in areas to be restored including, but not limited to, fixtures, fittings, finish hardware, and accessories; reinstall upon completion.

C. Separate areas to be protected from restoration areas to prevent damage.

D. Mask or cover adjacent surfaces and permanent equipment. Secure coverings without nails or tapes that leave residue. Do not use impervious sheeting which produces condensation.
   1. Use materials that withstand cleaning and restoration procedures.

3.03 IN SITU RESTORATION

A. Stabilize and repair wood to reestablish structural integrity and weather resistance while maintaining existing form of each item.

B. Do not mix or apply materials or products when the ambient temperature or humidity are outside range recommended by their manufacturers.

C. Schedule conservation treatments to avoid weather-related failures.

3.04 PAINT REMOVAL

A. Removal of Unsound Paint Layers: Use hand tools and sanders to remove flaking, cracking, blistering, peeling, or otherwise deteriorated coatings without marring or otherwise damaging substrates.

B. Leave surfaces in a clean, residue-free condition, ready for subsequent restoration procedures.

C. Dispose of waste products and residue in accordance with applicable laws and regulations.

3.05 WOOD REPLACEMENT

A. Match existing elements unless otherwise required for protection of wood materials from the weather and approved by Architect.

B. Maintain continuity of historic architectural fabric.

C. Rough Carpentry Elements:
   1. Set structural members level and plumb.
   2. Provide for erection loads, and temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.
   3. Do not field cut or alter structural members without approval of Architect.

4. After erection, touch-up primed surfaces with primer.

D. Finish Carpentry:
   1. Exterior Elements: Coordinate sequence of reinstallation with period treatment sequences of other exterior elements.
      a. General: Use corrosion-resistant fasteners.
      b. Set and secure materials and components in place, plumb, and level.
      c. Scribe to abutting components, with gaps of 1/32 inch, maximum. Do not use overlay trim to conceal larger gaps.
      d. Exterior Trim: Install with gap widths between pieces matching adjacent, original construction.
         1) Do not nail through overlapping pieces.
         2) Nails: Stainless steel, high tensile strength aluminum, or hot-dipped galvanized nails with ring or spiral-threaded shanks.
            (a) Nailing: Use casing nails to blind-nail; siding or box nails to face-nail.
         3) Drive nails manually; do not use nail guns.
         4) Do not over drive nails to prevent distortion of face or splitting of wood element.
      e. Cornices: Fit replacement pieces to remaining elements, with gap widths between pieces matching adjacent, original construction.
         1) Masonry Walls: Anchor preservative-treated supporting wood blocking and framing to masonry.
      f. Soffits and Fascia: Fit replacement pieces to remaining elements, with gap widths between pieces matching adjacent, original construction.
      g. Balustrades, and Handrails: Fit replacement pieces in with remaining elements.
         1) Fasten and fit elements with flush joints.
      h. Pediments: Fit replacement pieces to remaining elements, with gap widths between pieces matching adjacent, original construction.
         1) Affix to existing elements with adhesives where using fasteners is not consistent with existing historic fabric.

3.06 WOOD REPAIR

A. Wood Filler Installation:
   1. Surface Preparation:
      a. General: Prepare substrate according to manufacturer's written instructions.
      b. Remove all paint and other coatings from area to be repaired.
      c. Examine area of removal to confirm complete elimination of decayed material. Remaining wood shall be of even color, without red-brown and/or grey spots. No soft wood, existing brittle compounds/fillers, or other previous repairs should remain.
      d. Sand to bare wood, thoroughly removing loose wood fibers, paint, saw dust, and dirt.
   2. Installation of Two-Part Epoxy Repair System:
      a. Primer: Pre-treat bare and sanded wood with primer/bonding agent.
         1) Allow bonding agent to penetrate wood surface for minimum of 10 minutes and maximum of 30 minutes, or as recommended by manufacturer. Avoid applying in direct sunlight.
         2) Remove any excess bonding agent with absorbing paper.
      b. Mixing: Mix epoxy repair system according to manufacturer's written instructions. Mix thoroughly and only as much as can be used within "pot life" period.
      c. Application: Apply epoxy repair compound over uncured epoxy primer.
         1) Epoxy fill shall have optimal contact with wood.
         2) Avoid inclusion of air pockets during application.
         3) Fill joints fill, even and smooth in one application.
      d. Curing: Allow full cure time as specified by epoxy manufacturer.
      e. Finishing:

1) After curing, sand surface even and smooth. Transitions and irregularities between wood and epoxy shall not be visible after sanding.
2) If required, smooth any remaining irregularities with additional application of epoxy repair compound. Always sand between coats.

B. Split Repair:
1. For splits smaller than 1/4 inch: Rout out, clean, and fill split with wood filler. Allow filler to cure and sand surface smooth.
2. For splits larger than 1/4 inch: Shape wood strip to fill split. Secure with adhesive. Plane or sand flush with adjoining surface.

C. Securing Loose Trim:
1. Set trim in original position
2. Secure trim with galvanized finishing nails of appropriate size. Pre-drill holes to avoid splitting wood.
3. Fill holes with wood filler matching profile and texture of adjoining surfaces.

D. Dutchman Installation:
1. Remove all paint and other coatings from area to be repaired.
2. Remove decayed, soft, and discolored wood. Remove additional 1/2-inch of adjoining sound wood. Remaining wood shall be of even color, without red-brown and/or grey spots. No soft wood, existing brittle compounds/fillers, or other previous repairs should remain.
3. Sand bare wood, thoroughly removing loose wood fibers, paint, saw dust and dirt.
4. Trim and square area of replacement. Carve cavity to geometric shape to allow easier shaping of dutchman.
5. Shape dutchman to fit cavity. Cut dutchman slightly smaller. Seam between existing wood and dutchman shall be 1/32 inch or less.
6. Check prepared dutchman piece for proper fit.
7. Mix adhesive components as recommended by manufacturer.
8. Apply thin layer of adhesive to dutchman and surfaces of void. Spread adhesive thinly on both faces keeping adhesive away from edges to avoid squeezing out.
9. Press dutchman into place. Joint shall be tight with only hairline glue lines.
10. Remove excess adhesive at glue line.
11. After adhesive has cured, carve or sand dutchman to match profile and texture of adjoining surfaces.

3.07 FINISHING

A. Field Finishing: Prepare elements for field finishing. Comply with requirements in Section 09 9113 - Exterior Painting.
1. Preparation: On exposed portions of woodwork remove handling marks or effects of exposure to moisture by sanding exposed surfaces with appropriate grit sandpaper.
2. Concealed Surfaces: Prime period woodwork that may be exposed to moisture, such as elements adjacent to exterior concrete or masonry walls.
3. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

3.08 CLEANUP

A. Upon completion, remove all tools, equipment and unnecessary materials from site. Remove and dispose masking materials following completion of Work. Return adjacent areas to clean conditions that existed prior to tart of Work.

B. Dispose hazardous waste materials according to manufacturer’s instructions by legal means.

END OF SECTION

SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:
   1. Wood grounds, nailers, and blocking.
   2. Wood furring.
   3. Sheathing.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 6 Section "Finish Carpentry" for nonstructural carpentry items exposed to view and not specified in another Section.
   2. Division 6 Section "Interior Architectural Woodwork" for interior woodwork specially fabricated for this Project.

1.03 DEFINITIONS

A. Rough carpentry includes carpentry work not specified as part of other Sections and generally not exposed, unless otherwise specified.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for the following products:
   1. Metal framing anchors.
   2. Construction adhesives.

C. Wood treatment data as follows including chemical treatment manufacturer's instructions for handling, storing, installation, and finishing of treated material:
   1. For each type of preservative treated wood product include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   2. For water-borne treated products include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.
   3. Material test reports from qualified independent testing laboratory indicating and interpreting test results relative to compliance of fire-retardant-treated wood products with requirements indicated.
   4. Warranty of chemical treatment manufacturer for each type of treatment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack lumber as well as plywood and other panels; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.
   1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

1.06 ENVIRONMENTAL CONSIDERATIONS

A. This project is designed and constructed with practices and procedures to meet the project’s environmental considerations and goals. These considerations and goals are to establish a facility which is environmentally responsible, profitable, and a healthy place to live and work. All interior applied paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for

Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

All interior applied adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

All composite wood shall be No Added Urea Formaldehyde (NAF) or Ultra Low Emitting Formaldehyde (ULEF) compliant.

PART 2 PRODUCTS

2.01 LUMBER, GENERAL

A. Lumber Standards: Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Inspection Agencies: Inspection agencies and the abbreviations used to reference them with lumber grades and species include the following:
   1. SPIB - Southern Pine Inspection Bureau.
   2. NLGA - National Lumber Grades Authority.

C. Grade Stamps: Provide lumber with each piece factory-marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber furnish pieces with grade stamps applied to ends or back of each piece; or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.
   1. Provide dressed lumber, S4S, unless otherwise indicated.
   2. Provide seasoned lumber with 19 percent maximum moisture content at time of dressing and shipment for sizes 2 inches or less in nominal thickness, unless otherwise indicated.

2.02 DIMENSION LUMBER

A. For light framing (non-load bearing) (2 to 4 inches thick, 2 to 4 inches wide) provide the following grade and species:
   1. "Construction" grade.
   2. Southern Pine graded under SPIB rules.
   3. Spruce Pine Fir graded under NLGA rules.

B. For structural light framing (2 to 4 inches thick, 2 to 4 inches wide), provide the following grade and species:
   1. "No. 2" grade or better.
   2. Same species as indicated on structural drawings.

C. For structural framing (2 to 4 inches thick, 5 inches and wider), provide the following grade and species:
   1. "No. 2" grade or better.
   2. Same species as indicated on structural drawings.

2.03 BOARDS

A. Exposed Boards: Where boards will be exposed in the finished work, provide the following:
   1. Moisture Content: 19 percent maximum, "S-DRY" or KD-19.
   2. Where painted finish is indicated, provide "No. 1 Boards" per SPIB rules, "Select Merchantable Boards" per WCLIB rules, or "No. 2 Common Boards & Better" per WWPA rules.

B. Concealed Boards: Where boards will be concealed by other work, provide lumber of 19 percent maximum moisture content (S-DRY or KD-19) and of following species and grade: Southern Pine No. 2 or Spruce Pine Fir No. 2.

2.04 MISCELLANEOUS LUMBER

A. General: Provide lumber for support or attachment of other construction including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.

B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.

C. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

D. Grade: "Standard" grade light-framing-size lumber of any species or board-size lumber as required. "No. 2 Boards" per SPIB rules.

2.05 CONSTRUCTION PANELS, GENERAL

A. Construction Panel Standards: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood construction panels and, for products not manufactured under PS 1 provisions, with APA PRP-108.

B. Trademark: Furnish construction panels that are each factory-marked with APA trademark evidencing compliance with grade requirements.

2.06 CONCEALED PERFORMANCE-RATED CONSTRUCTION PANELS

A. General: Where construction panels are indicated for the following concealed types of applications, provide APA Performance-Rated Panels complying with requirements designated under each application for grade designation, span rating, exposure durability classification, edge detail (where applicable), and thickness.

B. Wall Sheathing, Plywood, or OSB: APA RATED SHEATHING.
   1. Exposure Durability Classification: EXTERIOR.
   2. Exposure Durability Classification: EXPOSURE 1.
   3. Span Rating: As required to suit stud spacing indicated.

2.07 CONSTRUCTION PANELS FOR BACKING

A. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant-treated plywood panels with grade designation, APA C-D PLUGGED EXPOSURE 1, in thickness indicated, or, if not otherwise indicated, not less than 15/32 inch.

2.08 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with a hot-dip zinc coating per ASTM A 153 or of AISI Type 304 stainless steel.

B. Nails, Wire, Brads, and Staples: FS FF-N-105.

C. Power Driven Fasteners: National Evaluation Report NER-272.

D. Wood Screws: ANSI B18.6.1.

E. Lag Bolts: ANSI B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

2.09 METAL FRAMING ANCHORS

A. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
   1. Current Evaluation/Research Reports: Provide products for which model code

evaluation/research reports exist that are acceptable to authorities having jurisdiction and that evidence compliance of metal framing anchors for application indicated with the building code in effect for this Project.

2. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.

B. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for Coating Designation G60 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.

1. Use galvanized steel framing anchors for rough carpentry exposed to weather, in ground contact, or in area of high relative humidity, and where indicated.

2.10 MISCELLANEOUS MATERIALS

A. Sill Sealer Gaskets: Glass fiber resilient insulation fabricated in strip form for use as a sill sealer; 1 inch nominal thickness compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated; in rolls of 50 feet or 100 feet in length.

B. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturer.

C. Water Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbonate (IPBC) as its active ingredient.

2.11 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. General: Where lumber or plywood is indicated as preservative-treated wood or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood). Mark each treated item with the AWPB or SPIB Quality Mark Requirements.

B. Pressure-treat above-ground items with water-borne preservatives to a minimum retention of 0.25 pcf. For interior uses, after treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates installed over concrete slabs directly in contact with earth.

C. Pressure-treat wood members in contact with the ground or fresh water with water-borne preservatives to a minimum retention of 0.40 pcf.

D. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects that impair quality of rough carpentry construction and that are too small to use in fabricating rough carpentry with minimum joints or optimum joint arrangement.

B. Set rough carpentry to required levels and lines, with members plumb and true to line and cut and fitted.

C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.

D. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; predrill as required.

3.02 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

C. Install permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.

3.03 WOOD FURRING

A. Install plumb and level with closure strips at edges and openings. Shim with wood as required for tolerance of finished work.
   1. Firestop furred spaces on walls at each floor level and at ceiling line of top story, with wood blocking or noncombustible materials, accurately fitted to close furred spaces.

B. Furring to Receive Plywood Paneling: Install 1-inch by 3-inch furring at 2 feet o.c., horizontally and vertically. Select furring for freedom from knots capable of producing bent-over nails and resulting damage to paneling.

C. Furring to Receive Gypsum Drywall: Install 1-inch by 2-inch furring at 16 inches o.c., vertically.

D. Furring to Receive Plaster Lath: Install 1-inch by 2-inch furring at 16 inches o.c., vertically.

E. Suspended Furring: Install suspended furring members of size and spacing indicated, including hangers and attachment devices. Level to a tolerance of 1/8 inch in 10 feet, except 1/4 inch in 10 feet for thick-coat plaster work.

3.04 WOOD FRAMING, GENERAL

A. Framing Standard: Comply with N.F.P.A. "Manual for Wood Frame Construction," unless otherwise indicated.

B. Install framing members of size and spacing indicated.

C. Anchor and nail as shown, and to comply with the following:
   1. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
   2. Published requirements of manufacturer of metal framing anchors.
   3. "Recommended Nailing Schedule" of referenced framing standard and with N.F.P.A. "National Design Specifications for Wood Construction."
   4. "Table No. II - Recommended Nailing Schedule" of the Uniform Building Code.
   5. "Appendix C - Recommended Nailing Schedule" of the BOCA National Building Code.
   6. "Table 1705.1 - Fastening Schedule," of the Standard Building Code.

END OF SECTION

SECTION 06 1600
SHEATHING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Roof sheathing.
   3. Composite nail base insulated roof sheathing.
   4. Subflooring.
   5. Underlayment.
   6. Sheathing joint and penetration treatment.

B. Related Requirements:
   1. Section 06 1000 "Rough Carpentry" for plywood backing panels.
   2. Section 07 2500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
   3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.04 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For following products, from ICC-ES:
   1. Preservative-treated plywood.
   2. Fire-retardant-treated plywood.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.06 DELIVERY, STORAGE, AND HANDLING

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

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory." GA-600, "Fire Resistance Design Manual.".

2.02 WOOD PANEL PRODUCTS

A. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
   1. Plywood.
   2. Oriented strand board.
   3. Fiberboard wall sheathing.
   4. Particleboard underlayment.
   5. Hardboard underlayment.

B. Plywood: Either DOC PS 1 or DOC PS 2 unless otherwise indicated.

C. Oriented Strand Board: DOC PS 2.

D. Thickness: As needed to comply with requirements specified, but not less than thickness indicated on drawings.

E. Factory mark panels to indicate compliance with applicable standard.

2.03 PRESERVATIVE-TREATED PLYWOOD

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

C. Application: Treat all plywood unless otherwise indicated and plywood in contact with masonry or concrete or used with roofing, flashing, vapor barriers, and waterproofing.

2.04 FIRE-RETARDANT-TREATED PLYWOOD

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.

4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according ASTM D 5516 and design value adjustment factors shall be calculated according to ASTM D 6305. Span ratings after treatment shall be not less than span ratings specified.

C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.

D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

E. Application: Treat all plywood unless otherwise indicated.

2.05 WALL SHEATHING

A. Plywood Wall Sheathing: Exposure 1 sheathing.
1. Span Rating: As indicated on drawings.
2. Nominal Thickness: As indicated on drawings.

B. Oriented-Strand-Board Wall Sheathing: Exposure 1 sheathing.
1. Span Rating: As indicated on drawings.
2. Nominal Thickness: As indicated on drawings.

C. Paper-Surfaced Gypsum Wall Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Huber Engineered Woods, LLC; ZIP System Roof/Wall Sheathing and ZIP System Seam Tape: www.huberwood.com/#sle.
2. Type and Thickness: As indicated on drawings.
3. Size: 48 by 96 inches for vertical installation.

2.06 ROOF SHEATHING

A. Plywood Roof Sheathing: Exposure 1 sheathing.
1. Span Rating: Not less than 24” o.c.
2. Nominal Thickness: As indicated on drawings.

B. Oriented-Strand-Board Roof Sheathing: Exposure 1 sheathing.
1. Span Rating: As indicated on drawings.
2. Nominal Thickness: As indicated on drawings.

2.07 SUBFLOORING AND UNDERLAYMENT

A. Oriented-Stand-Board Combination Subfloor-Underlayment: Exposure 1 single-floor panels.
1. Span Rating: Not less than 16 o.c.
2. Nominal Thickness: Not less than 23/32 inch.
3. Edge Detail: Square.
4. Edge Detail: Tongue and groove.

2.08 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

1. For wall and roof sheathing panels, provide screws with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

F. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
   1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
   2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

G. Screws for Fastening Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117. Provide washers or plates if recommended by sheathing manufacturer.

2.09 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Paper-Surfaced Gypsum Sheathing: Elastomeric, medium-modulus, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 07 9200 "Joint Sealants."

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:
   1. Combination Subfloor-Underlayment:
      a. Nail to wood framing.
      b. Space panels 1/8 inch apart at edges and ends.
   2. Subflooring:
      a. Nail to wood framing.

b. Space panels 1/8 inch apart at edges and ends.

3. Wall and Roof Sheathing:
   a. Nail to wood framing.
   b. Space panels 1/8 inch apart at edges and ends.
4. Underlayment:
   a. Nail to subflooring.
   b. Space panels 1/32 inch apart at edges and ends.

3.03 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to wood framing with nails or.
   2. Fasten gypsum sheathing to cold-formed metal framing with screws.
   3. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
   4. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
   1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
   2. For sheathing under stucco cladding, boards may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.
   1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
   2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION

SECTION 06 1700
PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 SUMMARY

A. Prefabricated wood trusses, complete, including roof trusses, floor trusses, and truss accessories.

1.02 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Supplemental framing, bracing, roof sheathing; Section 06 1600.

1.03 SUBMITTALS

A. Comply with Section 01 30 00.

B. Product Data: Submit fabricator's technical data covering lumber, metal plates, hardware, fabrication process, handling, and erection.

C. Certificate: Submit certificate, signed by an officer of fabricating firm, indicating that trusses to be supplied for project comply with indicated requirements.

D. Shop Drawings:
   1. Submit shop drawings showing species, sizes and stress grades of lumber to be used; pitch, span, camber, configuration and spacing for each type of truss required; type, size, material, finish, design value, and location of metal connector plates; and bearing and anchorage details.
   2. To the extent engineering design considerations are indicated as fabricator's responsibility, submit design analysis and test reports indicating loading, section modulus, assumed allowable stress, stress diagrams and calculations, and similar information needed for analysis and to ensure that trusses comply with requirements. Provide shop drawings which have been signed and stamped by a structural engineer licensed to practice in the state where trusses are installed.

1.04 QUALITY ASSURANCE

A. TPI Standards: Comply with applicable requirements and recommendations of the following Truss Plate Institute (TPI) publications:
   1. "Design Standard for Metal Plate Connected Wood Truss Construction".
   2. "Commentary and Recommendations for Handling, Installing, and Bracing Metal Plate Connected Wood Trusses".
   3. "Quality Standard for Metal Plate Connected Wood Trusses".

B. Wood Structural Design Standard: Comply with applicable requirements of "National Design Specifications for Wood Construction" published by A.F.P.A.

C. Design By Manufacturer: Trusses shall be designed by connector-plate manufacturer to support superimposed dead and live loads indicated, with design approved and certified by a structural engineer licensed to practice in jurisdiction where trusses will be installed.

D. Connector Plate Manufacturer's Qualifications: Provide truss connector plates manufactured by a firm which is a member of TPI and which complies with TPI quality control procedures for manufacture of connector plates published in TPI "Quality Standard for Metal Plate Connected Wood Trusses".

E. Fabricator's Qualifications: Provide trusses by firm which has a record of successfully fabricating trusses similar to type indicated and which complies with following requirements for quality control:
   1. Fabricator participates in TPI "Quality Assurance Inspection Program" as a licensee authorized to apply TPI marks to trusses.

2. Fabricator practices a quality control program which complies with, or is comparable to, one published in TPI "Quality Standard for Metal Plate Connected Wood Trusses" and which involves inspection by an independent inspection and testing agency acceptable to Architect and authorities having jurisdiction.

F. Uniformity of Manufacture for Connector Plates: Provide metal connector plates from a single manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle and store trusses with care, and in accordance with manufacturer's instructions and TPI recommendations to avoid damage from bending, overturning or other cause for which truss is not designed to resist or endure.

B. Time delivery and erection of trusses to avoid extended on-site storage and to avoid delaying work of other trades whose work must follow erection of trusses.

1.06 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Maximum Deflection Under Design Loads:
    a. Roof Trusses: Vertical deflection of 1/360 of span.
    b. Roof Trusses: Horizontal deflection at reactions of 1-1/4 inches.

1.07 ENVIRONMENTAL CONSIDERATIONS

A. This project is designed and constructed with practices and procedures to meet the project's environmental considerations and goals. These considerations and goals are to establish a facility which is environmentally responsible, profitable, and a healthy place to live and work. All interior applied paints and coatings wet-applied on site must meet the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective June 3, 2011.

All interior applied adhesives and sealants wet-applied on site must meet the applicable chemical content requirements of SCAQMD Rule 1168, July 1, 2005, Adhesive and Sealant Applications, as analyzed by the methods specified in Rule 1168. The provisions of SCAQMD Rule 1168 do not apply to adhesives and sealants subject to state or federal consumer product VOC regulations.

All composite wood shall be No Added Urea Formaldehyde (NAF) or Ultra Low Emitting Formaldehyde (ULEF) compliant.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Metal Connector Plates:
    a. Alpine Engineered Products, Inc.
    b. Computrus, Inc.
    c. Mitek Ind.
    d. Robbins Mfg. Co.
    e. Tee-Lok Corp.
    f. Truswall Systems Corp.

2. Metal Framing Anchors:
    a. Cleveland Steel Specialty Co.
    b. Harlen Metal Products, Inc.
    c. Silver Metal Products, Inc.
    d. Simpson Strong-Tie Company, Inc.
    e. Southeastern Metals Mfg. Co.
    f. United Steel Products Co.

2.02 MATERIALS

A. Lumber:
    1. Manufacturer lumber to comply with DOC PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review. NOTE: No. 3 lumber will not be allowed
    2. Factory mark each piece of lumber with type, grade, mill and grading agency.

B. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for dressed lumber, S4S. Provide seasoned lumber with a maximum moisture content of 19% at time of dressing. Minimum size shall be nominal 2” X 4”

C. Lumber Species: Southern pine, No.2, graded by SPIB.

D. Stress Rating: Provide lumber which has been graded or tested and certified, at indicated moisture content, to be in compliance with required stress ratings.

E. Metal Connector Plates, Fasteners and Anchorages: No connector plates shall be smaller than 3" X 5" or 4” X 4”.
    1. Connector Plate Material: Fabricate from metal complying with following requirements:
        a. Hot-Dip Galvanized Sheet Steel: Structural quality complying with ASTM A 446, Grade A; zinc coated by hot-dip process to comply with ASTM A 525, Designation G60; minimum coated metal thickness indicated, but not less than .036".

F. Fasteners: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and fabrication.
    1. Nails, Wire, Brads, Staples: FS FF-N-105.
    2. Power Driven Fasteners: National Evaluation Report NER-272.
    3. Wood Screws: ANSI B18.6.1.
    4. Lag Bolts: ANSI B18.2.1.
    5. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and where indicated, flat washers.

G. Metal Framing Anchors:
    1. General: Provide metal framing anchors of type, size, metal, and finish indicated that comply with requirements specified including the following:
        a. Current Evaluation/Research Reports: Provide products for which reports exist from model code organization acceptable to
        authorities having jurisdiction that evidence compliance of metal framing anchors for application indicated within building code in effect for this project.
        b. Allowable Design Loads: Provide products for which manufacturer publishes allowable design loads that are determined from empirical data or by rational engineering analysis and that are demonstrated by comprehensive testing performed by a qualified independent testing laboratory.

2. Galvanized Steel Sheet: Steel sheet zinc-coated by hot-dip process on continuous lines prior to fabrication to comply with ASTM A 525 for coating designation G60 and with ASTM A 446, Grade A (structural quality); ASTM A 526 (commercial quality); or ASTM A 527 (lock-forming quality); as standard with manufacturer for type of anchor indicated.
3. Truss Ties: 18 gage galvanized steel bent strap tie for fastening trusses. Types as indicated on drawings.

2.03 FABRICATION

A. Cut truss members to accurate lengths, angles and sizes to produce close fitting joints with wood-to-wood bearing in assembled units.

B. Fabricate metal connector plates to size, configuration, thickness and anchorage details required for types of joint designs indicated.

C. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with close fitting joints. Position members to produce design camber indicated.

D. Connect truss members by means of metal connector plates accurately located and securely fastened to wood members by means indicated or approved.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Erect and brace trusses to comply with recommendations of manufacturer and the Truss Plate Institute.
1. Where trusses do not fit, return to fabricator and replace with trusses of correct size; do not alter trusses in field.
2. Erect trusses with plane of truss webs vertical (plumb) and parallel to each other, located accurately at design spacings indicated.
3. Hoist units in place by means of lifting equipment suited to sizes and types of trusses required, applied at designated lift points as recommended by fabricator, exercising care not to damage truss members or joints by out-of-plane bending or other causes.
4. Provide temporary bracing as required to maintain trusses plumb, parallel and in location indicated, until permanent bracing is installed.
5. Anchor trusses securely at all bearing points to comply with methods and details indicated.
6. Securely connect each truss ply required for forming girder trusses. Anchor trusses to girder trusses as indicated.
7. Install permanent bracing and related components to enable trusses to maintain design spacing, withstand live and dead loads including lateral loads, and to comply with other indicated requirements.
8. Do not cut or remove truss members.

END OF SECTION

SECTION 061740

COMPOSITE STRUCTURAL LUMBER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Laminated Veneer Lumber (LVL))

B. Parallel Strand Lumber (PSL)

C. Laminated Stand Lumber (LSL)

1.02 SUMMARY

A. Related Sections:
   1. Framing Connectors and Hangers: Section 061000.

1.03 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D2559 – Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions.
   2. ASTM D5456 Standard Specification for Evaluation of Structural Composite Lumber Products.

B. Forest Stewardship Council A.C. (FSC):
   1. STD-40-003 Standard for Multi-site Certification of Chain of Custody Operations.
   2. STD-40-004 V2.0 FSC Standard for Chain of Custody Certification.
   3. STD-40-005 V2.1 Standard for Company Evaluation of FSC Controlled Wood.

C. International Code Council Evaluation Service (ICC-ES):
   1. Report Number: ESR-2993.

D. National Institute of Standards & Technology:
   1. PS 1 – Structural Plywood
   2. Voluntary Product Standard PS 2 Performance Standard for Wood-Based Structural-Use Panels.

1.04 ACTION SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Section 01.

B. Product Data: Submit for specified products as follows:
   1. Manufacturer's product data, including descriptions of component materials, dimensions of specified products, design properties, allowable spans and construction details.
   2. Manufacturer's installation instructions.
   3. Catalog pages illustrating products to be incorporated into project.
   4. Material Safety Data Sheets (MSDS).

C. Shop Drawings: Submit drawings sealed by the designer indicating member types, sizes, locations and connection details.

D. Design Data: Submit design calculations sealed by the designer for representative structural members.

1.05 INFORMATION SUBMITTALS

A. General: Submit listed submittals in accordance with Contract Conditions and Section 013000.

B. Source Quality Control: Submit documentation verifying that components and materials specified in this Section are from a single manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: A professional structural engineer registered in the State of Arkansas.

1.07 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01.

B. Delivery and Acceptance Requirements: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Unload material in accordance with manufacturer's recommendations.

C. Storage and Handling Requirements: Handle and store materials in accordance with manufacturer's recommendations. Protect from exposure to harmful environmental conditions.

PART 2 - PRODUCTS

2.01 LAMINATED VENEER LUMBER (LVL)

A. Manufacturer:
   1. Boise Cascade: www.bc.com
   2. Anthony Forest Products: www.anthonyforest.com
   3. Georgia-Pacific Corporation: www.gp.com
   4. LP Building Products: www.lpcorp.com
   5. Weyehaeuser: www.woodbywy.com
   6. Red Built: www.redbuilt.com

B. Description:
   1. Regulatory Requirements:
      a. Comply with ICC-ES Report Number ESR-1387.
   2. Compatibility:
      a. Ensure components and materials are compatible with specified accessories and adjacent materials.

C. Design Criteria:
   1. Design Floor Live Load: as specified with deflection limited to 1/360 of span.
   2. Design Roof Live Load: as specified with deflection limited to 1/360 of span.

2.02 MATERIALS

A. LVL (Microlam): Manufactured in a continuous process, with all grain parallel with the length of the members with published span rating to meet project requirements. All members are to be free of finger joints, scarf joints, or mechanical connection in full-length members.
   1. Span Rating: Established and monitored in accordance with ASTM D5456 by independent inspection agency.
   2. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559 and Meet requirements of D5055.
   3. Depth: As indicated on drawings.
   4. Fabrication Tolerances:
      a. Finished Length (as specified): Flange Width: Plus/minus 1/8 inch.
      b. Depth: Plus/minus 1/16 inch.
      c. Width: Plus/minus 1/16 inch.
   5. Adhesive: Meets requirements of ASTM D2559.
   6. Marking: Stamp indicating the product type and grade, ICC-ES evaluation report number, manufacturer’s name, plant number, date of fabrication and the independent inspection agency’s logo.
   7. Shear modulus of elasticity: G = 125,000 psi
   8. Modulus of elasticity: E = 2,000,000 psi
   9. Flexural stress: F_b = 2,600 psi
   10. Tension stress: F_t = 1,555 psi
   11. Compression perpendicular to grain parallel to wide face of strands: $F_{c\ perpendicular}$ = 750 psi
   12. Compression parallel to grain: $F_{c\ parallel}$ = 2,510 psi
   13. Horizontal shear perpendicular to wide face of strands: F_v = 285 psi

B. PSL (Parallam): Manufactured in a continuous process, with all grain parallel with the length of the members with published span rating to meet project requirements. All members are to be free of finger joints, scarf joints, or mechanical connection in full-length members.
   1. Span Rating: Established and monitored in accordance with ASTM D5456 by independent inspection agency.
   2. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559 and Meet requirements of D5055.
   3. Depth: As indicated on drawings.
   4. Fabrication Tolerances:
      a. Finished Length (as specified): Flange Width: Plus/minus 1/8 inch.
      b. Depth: Plus/minus 1/16 inch.
      c. Width: Plus/minus 1/16 inch.
   5. Adhesive: Meets requirements of ASTM D2559.
   6. Marking: Stamp indicating the product type and grade, ICC-ES evaluation report number, manufacturer's name, plant number, date of fabrication and the independent inspection agency's logo.
   7. Shear modulus of elasticity: G = 125,000 psi
   8. Modulus of elasticity: E = 2,000,000 psi
   9. Flexural stress: F_b = 2,900 psi
   10. Tension stress: F_t = 2,025 psi
   11. Compression perpendicular to grain parallel to wide face of strands: $F_{c\ perpendicular}$ = 750 psi
   12. Compression parallel to grain: $F_{c\ parallel}$ = 2,900 psi
   13. Horizontal shear perpendicular to wide face of strands: F_v = 290 psi

C. LSL (Timberstand): Manufactured in a continuous process, with all grain parallel with the length of the members with published span rating to meet project requirements. All members are to be free of finger joints, scarf joints, or mechanical connection in full-length members.
   1. Span Rating: Established and monitored in accordance with ASTM D5456 by independent inspection agency.
   2. Adhesive: Tested for wet/exterior service in accordance with ASTM D2559 and Meet requirements of D5055.
   3. Depth: As indicated on drawings.
   4. Fabrication Tolerances:
      a. Finished Length (as specified): Flange Width: Plus/minus 1/8 inch.
      b. Depth: Plus/minus 1/16 inch.
      c. Width: Plus/minus 1/16 inch.
   5. Adhesive: Meets requirements of ASTM D2559.
   6. Marking: Stamp indicating the product type and grade, ICC-ES evaluation report number, manufacturer's name, plant number, date of fabrication and the independent inspection agency's logo.
   7. Shear modulus of elasticity: G = 96,875 psi
   8. Modulus of elasticity: E = 1,550,000 psi
   9. Flexural stress: F_b = 2,325 psi
   10. Tension stress: F_t = 1,070 psi
   11. Compression perpendicular to grain parallel to wide face of strands: $F_{c\ perpendicular}$ = 900 psi
   12. Compression parallel to grain: $F_{c\ parallel}$ = 2,170 psi
   13. Horizontal shear perpendicular to wide face of strands: F_v = 310 psi

D. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.

E. Joist Bridging: Type, size and spacing recommended by joist manufacturer.

F. Wood Blocking, Plate and Miscellaneous Framing: Softwood lumber, Southern Pine, construction grade, maximum moisture content of 19 percent.

G. Fasteners: Electro-galvanized steel, type to suit application.

2.03 ACCESSORIES

A. Fasteners: Galvanized steel, sized to suit application.
   1. Acceptable Manufacturers:
      a. Simpson Strong-Tie.
      b. USP Structural Connectors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that conditions of substrates previously installed under other sections or contracts are acceptable for product installation in accordance with manufacturer's instructions prior to engineered wood I-joist installation.
   1. Inform Architect of unacceptable conditions immediately upon discovery.
   2. Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval from Architect and Consultant.

B. Verify that supports and openings are ready to receive LVL.

C. Verify that field measurements are as indicated on shop drawings.

3.02 PREPARATION

A. Coordinate placement of bearing items.

3.03 INSTALLATION

A. Coordinate LVL installation with work of other trades for proper time and sequence to avoid construction delays.

B. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions, for installation.

C. Install LVL plumb, level and as indicated.

D. Fasten LVL to supporting framing as recommended by the LVL manufacturer and hanger manufacturer.

E. Provide temporary bracing as recommended by the manufacturer to hold LVL in position until permanently secured.

F. Make provisions for erection loads and for sufficient temporary bracing and maintain structure plumb and in true alignment until completion of erection and installation of permanent bracing.

G. Install permanent bridging and bracing.

H. Install headers and supports to frame openings required.

I. Do not field cut or alter structural members without approval of Architect.

3.04 SITE TOLERANCES

A. Framing Members: Not more than 1/2 inch from indicated position.

3.05 CLEANING

A. Perform cleanup in accordance with Division 01.

B. Upon completion and verification of performance of installation, remove surplus materials, rubbish, tools and equipment in accordance with Division 01.

END OF SECTION

SECTION 06 1800
GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Glue laminated wood beams and purlins.

B. Steel hardware and attachment brackets.

1.02 REFERENCE STANDARDS

A. AITC A190.1 - American National Standard for Wood Products - Structural Glued Laminated Timber; 2007.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

G. ASTM D2559 - Standard Specification for Adhesives for Bonded Structural Wood Products for Use Under Exterior Exposure Conditions; 2012a.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

I. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

J. AITC 110 - Standard Appearance Grades for Structural Glued Laminated Timber.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 SUBMITTALS

A. See Division 01 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials, application technique and resultant performance information.

C. Shop Drawings: Indicate framing system, sizes and spacing of members, loads and cambers, bearing and anchor details, bridging and bracing, framed openings, and connection details.
   1. Submit design calculations signed and sealed by design engineer.

D. Designer's Qualification Statement.

E. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural members under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Arkansas.

B. Manufacturer/Fabricator Qualifications: Company specializing in manufacture of glue laminated structural units with three years of documented experience, and certified by AITC in accordance with AITC A190.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect members to AITC requirements for not wrapped.

B. Leave individual wrapping in place until finishing occurs.

C. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads shown on Drawings without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D3737 and acceptable to authorities having jurisdiction.

B. Seismic Performance: Structural glued-laminated timber and connectors shall withstand the effects of earthquake motions determined according to ASCE 7-10.

2.02 MANUFACTURERS

A. Glued-Laminated Structural Units:
   1. Structural Wood Systems; https://structuralwood.com/SWS.
   2. Western Wood Structures, Inc; www.westernwoodstructures.com/#sle.
   3. Or Approved Equal.

2.03 GLUED-LAMINATED UNITS

A. Glued-Laminated Units: Fabricate in accordance with AITC 110 Architectural Appearance Grade.
   1. Provide structural glued-laminated timber made from single species and grade.
   2. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
   3. Verify dimensions and site conditions prior to fabrication.
   4. Cut and fit members accurately to length to achieve tight joint fit.
   5. Fabricate member with camber built in.
   6. Do not splice or join members in locations other than those indicated without permission.
   7. After end trimming, seal with penetrating sealer in accordance with AITC requirements.

2.04 MATERIALS

A. Lumber:
   1. Southern Yellow Pine softwood lumber or approved equivalent complying with AITC 110 grading rules with 12 percent maximum moisture content before fabrication.
   2. Provide structural glued-laminated timber made from single species and grade.
   3. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.

B. Steel Connections and Brackets: ASTM A36/A36M weldable quality.

C. Anchor Bolts: ASTM F1554 Grade 36 with heavy hex bolts and nuts; hot-dip galvanized to meet requirements of ASTM A153/A153M, matching washers.

D. Laminating Adhesive: Tested for wet/exterior service in accordance with ASTM D2559.

E. Metal Primer: Compatible with finish paint system.

2.05 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

2.06 FABRICATION

A. Fabricate glue laminated structural members in accordance with AITC Architectural Appearance Grade.

B. Verify dimensions and site conditions prior to fabrication.

C. Cut and fit members accurately to length to achieve tight joint fit.

D. Fabricate member with camber built in.

E. Do not splice or join members in locations other than those indicated without permission.

F. Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates in areas to receive structural glued-laminated timber, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify sufficient end bearing area.

3.02 INSTALLATION

A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.
   1. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.

B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.
   1. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.
   2. Predrill for fasteners using timber connectors as templates.
   3. Finish exposed surfaces to remove planning or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.
   4. Coat cross cuts with end sealer.
   5. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.
      a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

C. Use copper naphthenate treatment for members in contact with the ground or not continuously protected from liquid water.

D. Install timber connectors as indicated.
   1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
   2. Install bolts with orientation as indicated or, if not indicated, as directed by Architect.

3.03 PROTECTION

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.
   1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.
   2. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

B. Swab and seal the interior wood surfaces of field drilled holes in members with primer.

C. Field Finishing: Specified in Division 09.

3.04 TOLERANCES

A. Framing Members: 3/8 inch maximum from true position.

END OF SECTION

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 1433 - Stile and Rail Wood Doors.

B. Section 09 9113 - Exterior Painting: Painting of finish carpentry items.

C. Section 09 9123 - Interior Painting: Painting of finish carpentry items.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

D. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2009.

E. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of finish plywood, 8x8 inch in size illustrating wood grain and specified finish.

E. Samples: Submit two samples of each type of wood trim 12 inch long.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Exterior Woodwork Items:
   1. Window Casings and Moldings: Softwood; prepare for paint finish.
   2. Soffits and Fascias: Prepare for paint finish.
   3. Enclosing Soffit Spaces: As detailed.
   4. Enclosing Structural Members: Softwood lumber; "PT" preservative treated.
   5. Pediments: Prepare for paint finish.
   6. T&G Wood (Tongue & Groove): Prepare for stain finish.
      a. Select, Grade A White Oak, Plain Slice, Prepare for stain finish.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
   2. Door, Glazed Light, and Pocket Door Frames: White birch; prepare for paint finish.
   3. Loose Shelving: Birch plywood; prepare for paint finish.

2.02 WOOD-BASED COMPONENTS

A. Provide sustainably harvested wood, certified or labeled as specified in Section 01 6000 - Product Requirements.

2.03 LUMBER MATERIALS

A. Exterior Finish Lumber Materials:
   1. Softwood Lumber:
      a. Western Red Cedar species, quartersawn or rift- sawn, maximum moisture content of 6 percent; with vertical grain.
      b. Bald Cypress species (Heartwood only), quartersawn or rift- sawn, maximum moisture content of 6 percent; with vertical grain.
      c. Grading: In accordance with rules certified by ALSC; www.alsc.org.

B. Interior Finish Lumber Materials:
   1. Softwood Lumber: White Pine species, Quarter- or plain- sawn, maximum moisture content of 6 percent; with vertical grain.
   2. Softwood Lumber: White Birch species, Quarter- or plain- sawn, maximum moisture content of 6 percent; with vertical grain.

2.04 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

2.05 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Concealed Joint Fasteners: Threaded steel.

2.06 ACCESSORIES

A. Lumber for Shimming, Blocking, and other concealed spaces: Softwood lumber of Southern Pine species.

B. Primer: Alkyd primer sealer.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.07 HARDWARE

A. Hardware: Comply with BHMA A156.9.

2.08 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.

C. Cap exposed plastic laminate finish edges with aluminum trim.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

E. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

F. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.09 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

1. Opaque:
    a. System - 1, Lacquer, Nitrocellulose.
    b. Color: As selected by Architect.
    c. Sheen: Satin.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

D. Install hardware in accordance with manufacturer's written instructions.

3.03 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Site Finishing: See Section 09 9113 and 09 9123.

C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.04 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD MILLWORK

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Custom made specially fabricated cabinet units and assemblies.

B. Countertops.

C. Hardware.

D. Factory finishing.

1.02 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
   2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Include certification program label.

C. Product Data: Provide data for veneer species, hardwood materials and hardware accessories.

D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, locksets, and wood veneer on specified substrate, demonstrating hardware design, quality, and finish. Provide veneer samples, 24" x 24" in size, stained and finished for Architect's approval.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs. Provide documentation that millwork meets or exceeds quality standard specified.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 MOCK-UP

A. Provide loose mock-up of typical countertop with edge condition, wood paneling, and order station front, including finishes.

B. Locate where directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Single Source Responsibility: Provide and install this work from single fabricator.

2.02 CABINETS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:
   1. Exposed Surfaces: Wood Grade AA, White Oak, plain sliced, book-matched, veneer stained / varnished.
   2. Semi-Exposed Surfaces: Wood Grade A, White Oak, plain sliced, book-matched, veneer stained / varnished.
   3. Concealed Surfaces: Manufacturer's option.

C. Cabinets:
   1. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
   2. Casework Construction Type: Type B - Face-frame.
   3. Interface Style for Cabinet and Door: Style 2 - Finish Inset; .
   4. Cabinet Design: As indicated on drawings.
   5. Adjustable Shelf Loading: 50 lbs. per sq. ft.
   6. Cabinet Style: Flush inset with face frame.
   7. Cabinet Doors and Drawer Fronts: flush style and stile and rail with flat panel style. See drawings..
   8. Drawer Construction Technique: Dovetail joints.

2.03 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.04 COUNTERTOPS & SILL SURFACES

A. Quartzite Surfacing: Natural stone composed primarily of quartz, characterized by high hardness, durability, and resistance to heat, scratching, and staining.
   1. Source: Pacific Shore Stone.
   2. Product:
      a. QTZ-04: Green Gaya (Gaya Gold) Quartzite.
   3. Stone Thickness: 2 cm minimum.
   4. Surface Finish: Polished.
   5. Surface Edge: Eased, 1/8" to 1/4" radius.
   6. Back and End Splashes: Same as material. Refer to drawings.
   7. Fabricate in accordance with AWI/AWMAC/WI (AWS) Standards, Section 11- Premium Grade.
   8. Slab Select: Slab shall be selected in person from a variety by Architect.
   9. Provider sealer for stone for outside use.

B. Quartz Surfacing: Quartz slabs bonded to substrate; use as large pieces as possible with inconspicuous adhesive joints.
   1. Product: Uniform surface without cracks, void or pin holes.
      a. QTZ-01: Consentino, Sensa, Itara, Polished
      b. QTZ-02: Consentino, Silestone, Blanc Elysee, Seude

c. QTZ-03: Consentino, Silestone, Taj Ivory, Polished
2. Stone Thickness: 2CM minimum.
3. Surface Finish: Varies.
4. Exposed Edge Treatment: Refer to drawings.
5. Back and End Splashes: Same as material. Refer to drawings.
6. Fabricate in accordance with AWI/AWMAC/WI (AWS) Standards, Section 11- Premium Grade.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic, painted metal, or rubber grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Shelf standards and Rests: Injection molded transparent polycarbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drileld holes and to prevent accidental rotation of support. The support automatically adapts to 19mm (3/4") or 25mm (1") thick shelving and provides a non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pound per support) without failure.

C. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome or satin chrome finish, for nominal 1 inch spacing adjustments.

D. Drawer and Door Pulls:
1. Product: Ansel Drawer Pull by Rejuvenation.
a. Finish: Unlacquered Brass.

E. Drawer and Door Knobs:
1. Product: Ansel Cabinet Knob by Rejuvenation.
a. Finish: Unlacquered Brass.
2. Push to Open:
a. Product: Tip-On by Blum.

F. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, brass finish..

G. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Commercial grade.
3. Weight Capacity: 100 LBS.
4. Mounting: Side mounted.
5. Stops: Integral type.
6. Features: Provide soft close type.
7. Manufacturers:
a. Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com/#sle.
b. Knape & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knapeandvogt.com/#sle.
c. Blum; Heavy-Duty Drawer Slide.

H. Hinges: European style concealed soft close type, steel with polished finish.

1. Manufacturers:
    a. Grass America Inc; TEC Soft-Close: www.grassusa.com/#sle.
    b. Grass America Inc; Tiomos Hinge System: www.grassusa.com/#sle.
    c. Blum, Inc: www.blum.com/#sle.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
    1. Provide center matched panels at each elevation.
    2. Provide sequence matching across each elevation.
    3. Carry figure of cabinet fronts to toe kicks.

F. Mechanically fasten back splash to countertops with steel brackets at 16 inches on center.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
    1. Transparent:
        a. System - 11, Polyurethane, Catalyzed.
        b. Stain: As selected by Architect.
        c. Sheen: Flat.
    2. Opaque:
        a. Color: As selected by Architect.
        b. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe millwork abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean millwork, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 07 0150.19
PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Replacement of existing roofing system in preparation for entire new roofing system.

B. Temporary roofing protection.

1.02 REFERENCE STANDARDS

A. ASTM C208 - Standard Specification for Cellulosic Fiber Insulating Board; 2012.

B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with affected mechanical and electrical work associated with roof penetrations.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Schedule work to coincide with commencement of installation of new roofing system.

1.04 QUALITY ASSURANCE

A. Materials Removal Company Qualifications: Company specializing in performing work of type specified with at least five years of documented experience.

1.05 FIELD CONDITIONS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Roofing Protection Materials:
   1. Plastic Sheeting: Provide polyethylene sheets; use weights to retain sheeting in position.

B. Protection Board: ASTM C208 cellulose fiber board, one face finished with mineral fiber, asphalt, and kraft paper.
   1. Provide protection board with the following characteristics:
   2. Board Size: 48 X 96 inch.
   3. Board Thickness: 3/4 inch.
   4. Board edges: Square.

C. Recover Board: Glass mat faced gypsum panels, ASTM C1177, moisture- and fire-resistant board with factory applied acrylic primer coating.
   1. Board size: 4 feet X 8 feet
   2. Board Thickness: 1/4 inch.
   3. Thermal Insulance (R Value): 0.28
   4. Board edges: Square.
   5. Products: Temple-Inland Building Products by Georgia-Pacific, LLC; GreenGlass Roof Board or GreenGlass Primed Roof Board: www.temple.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing roof surface is clear and ready for work of this section.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter.

B. Remove loose refuse and dispose of properly off-site.

3.03 MATERIAL REMOVAL

A. Remove only existing roofing materials that can be replaced with new materials the same day.

B. Remove metal counter flashings.

C. Remove damaged portions of roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets.

D. Cut and lay flat any membrane blisters.

E. Remove damaged insulation and fasteners, cant strips, and blocking.

F. Repair existing steel deck surface to provide smooth working surface for new roof system.

3.04 FIELD QUALITY CONTROL

A. The drawings identify the approximate limits to material removal.

B. Testing will identify the condition of existing materials and their reuse, repair or removal.

C. Test Reports: Indicate existing insulation moisture content.

3.05 PROTECTION

A. Provide temporary protective sheeting over uncovered deck surfaces.

B. Turn sheeting up and over parapets and curbing. Retain sheeting in position with weights.

C. Provide for surface drainage from sheeting to existing drainage facilities.

D. Do not permit traffic over unprotected or repaired deck surface.

E. Install recovery board over existing membrane at locations indicated.

END OF SECTION

SECTION 07 1300
SHEET WATERPROOFING

PART 1 GENERAL V.25

1.01 SECTION INCLUDES

A. Sheet membrane waterproofing system with drainage panels at below-grade foundations.
   1. Composite HDPE/Bentonite sheet membrane.

1.02 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2014.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

D. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for membrane, flexible flashings, and joint cover sheet.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 MOCK-UP

A. Construct mock-up consisting of 100 sq ft of horizontal waterproofed panel; to represent finished work including internal and external corners, seam jointing, attachment method, and drainage panel.
   1. Locate where directed.
   2. Mock-up may remain as part of this Work.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.07 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year NDL manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING APPLICATIONS

A. Composite HDPE/Bentonite Sheet Membrane:
   1. Location: Below-grade walls, elevator pits.
   2. Vertical Surfaces: Mechanically attached.
   3. Horizontal Surfaces: Mechanically attached.
   4. Cover with drainage panel.

2.02 MEMBRANE MATERIALS

A. Composite HDPE/Bentonite Sheet Membrane: Comprised of black/gray HDPE and granular bentonite with spun polypropylene fabric facing.
   1. Thickness: 150 mils, 0.150 inch, minimum.
   2. Sheet Width: 4 feet, minimum.
   3. Bentonite: Granulated pure, dry, bentonite clay compromised of 90 percent minimum sodium montmorillonite; 90 percent minimum passing No. 20 mesh sieve and 10 percent maximum passing No. 200 mesh sieve.
      a. Minimum bentonite content: 1 lb/sq ft.
   4. With compatible waterstop devices and 4 inch (100 mm) wide rubberized asphalt seam tape.
   5. Tensile Strength: 4000 psi, measured in accordance with ASTM D412.
   6. Water Vapor Permeability: 2.7 x 10 -13 cm/sec or _ perm inch measured in accordance with ASTM E96/E96M.
   7. Manufacturers:
      a. CETCO, a division of Minerals Technologies Inc; ULTRASEAL: www.mineralstech.com/#sle.
      b. Epro Services, Inc; Bento-Pro Plus: www.eproserv.com/#sle.
      c. Tremco Commercial Sealants & Waterproofing; Paraseal: www.tremcosealants.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 ACCESSORIES

A. Sealant for Substrate Surfaces: Type as required by sheet manufacturer or as specified in Section 07 9200.

B. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.
   1. Polystyrene foam board, 1 inch thick.

C. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
   1. Composition: Dimpled core; polypropylene filter fabric.

D. Cant Strips: Premolded composition material.

E. Termination bars: Stainless steel or Aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

G. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate according to ASTM D5295/D5295M.
   1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
   2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in the reference standard.
   3. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in the referenced standard.
   4. Test concrete surfaces as described in the referenced standards. Verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Install cant strips at all 90 degree vertical transitions in foundation walls. Membrane to extent minimum 12 inches horizontally on foundation.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Extend membrane over cants and up intersecting surfaces at membrane perimeter minimum 6 inches above horizontal surface for first ply and 6 inches at subsequent plies laid in shingle fashion.

I. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

B. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

C. Adhere protection board to substrate with compatible adhesive.

3.05 FIELD QUALITY CONTROL

A. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

B. Flood to minimum depth of 1 inch with clean water, and after 48 hours inspect for leaks.

C. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.

D. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall, underside of floor slabs, exterior wall behind masonry wall finish, and over low-slope roof deck.

B. Batt insulation in exterior and interior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Installation requirements for board insulation over steep slope roof sheathing or roof structure.

B. Section 07 2119 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.

C. Section 13 3413 - Glazed Structures: Coordinate installation of additional insulation board below pre-manufactured roof system.

1.03 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

D. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2015a.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

H. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

I. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

J. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Installation schedule: Provide description of locations where each proposed product will be installed. Include description of compliance with fire rated, acoustical and NFPA 285 details.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATION SCHEDULE

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundations, below grade: Extruded polystyrene (XPS) board.

C. Insulation at Perimeter of Foundations, above grade: Mineral Wool Board.

D. Insulation as Protection Board at Foundations, below grade only: Extruded polystyrene (XPS) board.

E. Insulation Inside Cavity of Masonry Veneer Walls, below grade only: Etruded polystyrene (XPS) board.

F. Insulation on Inside Cavity of Masonry Veneer Walls, above grade: Extruded polystyrene (XPS) board.

G. Insulation behind exterior Metal Wall Panels: **Mineral Wood board.**

H. Insulation inside STC and Fire Rated partitions: SAFB Mineral Wool Insulation, no vapor retarder.

I. Insulation inside Wood Framed Walls: Batt insulation with no vapor retarder.

J. Insulation in Framed Ceiling Structure: Batt insulation with separate vapor retarder.

K. Insulation Over Roof Deck: Extruded polystyrene (XPS) board.

2.02 BOARD INSULATION MATERIALS

A. Extruded Polystyrene Board Insulation **(XPS)**: ASTM C578, Type IV; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Board Size: 48 x 96 inch.
   4. Board Thickness: 1-1/2 inches, or unless indicated otherwise.
   5. Board Edges: Shiplap.
   6. Thermal Conductivity (k factor) at 25 degrees F: 0.18 (R= 5 minimum per inch).
   7. Compressive Resistance: 25 psi.
   8. Manufacturers:
      a. Dow Chemical Company: www.dow.com/#sle.
      b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.
      c. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Mineral Wool Board Insulation: Rigid or semi-rigid stone wool insulation, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Combustibility: Behavior of material at 750 degrees as non-combustible per ASTM E136.
   2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   3. Board Size: 16 by 48 inches standard, size varies by manufactuer,.
   4. Board Thickness: 2 inches and/or as indicated on drawings.
   5. Thermal Resistance: R-value of 4.3 per inch at 75 degrees F, minimum, when tested according to ASTM C518.
   6. Minimum Density: 4.3 pound per cubic foot, nominal.
   7. Manufacturers:

a. Basis-of-Design: ROCKWOOL (ROXUL, Inc); CAVITYROCK Black: www.rockwool.com/#sle. For additional insulation below insulated metal roof panels within pre-manufactured glazed structure. See Section 13 3413.
b. Johns Manville;CladStone 45 ____: www.jm.com/#sle.
c. Thermafiber, Inc;RainBarrier ic HC 80 _____: www.thermafiber.com/#sle.

8. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or SAFB mineral wool insulation may be used, at Contractor's option, unless specifically noted or required otherwise.
1. Use Sound Attenuation Fire Blanket (SAFB) Mineral Wool at all fire rated assemblies and STC rated wall per drawings and partition schedule and as required by code/UL test.

B. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 50 or less, when tested in accordance with ASTM E84.
3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
4. Formaldehyde Content: Zero.
5. Thermal Resistance: R-value of 3.5 per inch minimum.
6. Thickness: Match cavity thickness or as indicated on drawings or insulation schedule.
7. Facing: Unfaced.
8. Manufacturers:
a. CertainTeed Corporation: www.certainteed.com/#sle.
b. Johns Manville: www.jm.com/#sle.
c. Knauf Insulation GmbH: www.knaufinsulation.us.
d. Owens Corning Corp: www.owenscorning.com.
9. Substitutions: See Section 01 6000 - Product Requirements.

C. Sound Attenuation Fire Blanket (SAFB) Mineral Wool: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Thermal Resistance: R-value of 3.5 per inch, minimum.
4. Thickness: Match cavity thickness, indicated on drawings or per insulation schedule.
5. Manufacturers:
a. Knauf Insulation; EcoBatt Insulation: www.knaufinsulation.com/#sle.
b. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch wide.

B. Insulation Fasteners:
1. Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
2. Galvanized steel or aluminum continuous retainer clips, to be mechanically fastened to aluminum framing, to receive insulation board, length to suit insulation thickness and installation requirements, capable of securely and rigidly fastening insulation in place.

C. Wire Mesh: Galvanized steel, hexagonal wire mesh.

D. Protection Board for Below Grade Insulation: XPS, 2 inch thick.

E. Adhesive: Type recommended by insulation manufacturer for application.

F. Spray-foam Insulation: See Section 07 2119 - Foamed-in-place Insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.
   2. Full bed 1/8 inch thick.

C. Install boards horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
   1. Apply adhesive in five continuous beads per board length.
   2. Install boards horizontally from base of foundation to top of insulation.
   3. Butt boards tightly, with joints staggered from insulation joints.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere a 6 inch wide strip of polyethylene sheet over building expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Mechanically fasten insulation boards to sheathing with rust resistant screws and 2" diameter rigid plastic washers to allow secure attachment.
   1. Install 24 inches each way or as prescribed by insulation manufacturer.

C. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and protrusions.

D. Extend boards over expansion joints, unbonded to wall on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Fill voids in walls and cavities around perimeter of openings with spray-foam insulation.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Secure impale fasteners to substrate at following frequency:
   1. Six (6) per insulation board.

B. Adhere a 6 inches wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

C. Install boards to fit snugly between wall ties.

D. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and protrusions.
   3. Place impale fastener locking discs.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Fill voids in walls and cavities around perimeter of openings with spray-foam insulation.

3.05 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

D. Install spray-foam insulation around gaps and voids in penetrations through board insulation.

3.06 BOARD INSTALLATION OVER LOW SLOPE ROOF DECK

A. Board Installation Over Roof Deck, General:
   1. See applicable roofing specification section for specific board installation requirements.
   2. Ensure vapor retarder is clean and dry, continuous, and ready for application of roofing system.
   3. Fasten insulation to deck in accordance with roofing manufacturer's written instructions and applicable Factory Mutual requirements.
   4. Do not apply more insulation than can be covered with roofing on the same day.

3.07 BOARD INSTALLATION OVER STEEP SLOPE ROOF SHEATHING OR ROOF STRUCTURE

A. Installation of board insulation over steep slope roof structure or roof sheathing is specified in Section 06 1000.

3.08 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in interior sound attenuated and exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Cut and form insulation as necessary to fully fill all cavities and void spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. At attic locations with gyp-bd ceilings, use spray foam around all penetrations through gyp-bd layer. Apply to seal all air leakage around pentrations and to insluate around device. Fill voids around plumbing pipes, conduits, wiring, junction boxes, etc poking though attic ceiling layer.

F. Install insulation in thicknesses required to achieve minimum desired R-values below; unless noted otherwise.
   1. Walls: R-19
   2. Floors: R-13
   3. Floors above unconditioned spaces: R-19
   4. Ceilings at unconditioned attic spaces: R-29

G. Fill voids in walls and cavities around perimeter of openings with spray-foam insulation. Fill shim spaces around window perimeters full with batt insulation or low-expanion spray-foam insulation.

3.09 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Foamed-in-place insulation installed as part of the exterior building thermal envelope.

B. At junctions of dissimilar wall and roof materials.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2014.

C. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements and shop drawings identifying locations being applied.

C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke limitations.

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F of dew point.

PART 2 PRODUCTS

MANUFACTURERS

2.01 FOAMED-IN-PLACE INSULATION:

A. BASF Corporation; WALLTITE US Series Closed Cell: www.spf.basf.com/#sle.

B. Icynene-Lapolla; Icynene ProSeal (MD-C-200 v3): www.icynene.com/#sle.

C. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: www.jm.com/#sle.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.

2. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
3. Water Absorption: Less than 1 percent by volume, maximum, when tested in accordance with ASTM D2842.
4. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
5. Closed Cell Content: At least 90 percent.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
7. Density: 2.0 lbs/cuft, nominal, in accordance with ASTM D1622/D1622M.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Overcoat: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply to achieve a thermal resistance R-value of 20.

D. Patch damaged areas.

E. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

F. Trim excess away for applied trim or remove as required for continuous sealant bead.

G. Apply insulation inside of building at all transitions from wall to roof, at underside of all roof ridges, hips and valleys, all penetrations through roofs, and as otherwise indicated at drawings.

H. Apply overcoat to surface at locations where it is not concealed behind 1/2" thick gypsum board. Overcoat to be equivalent to a 15 minute thermal barrier as required by IBC.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.02 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2013).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

F. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc.; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation and installation methods.

1.05 MOCK-UP

A. Install air barrier materials as part of integrated mock-up of exterior wall assembly.
   1. Incorporate backup wall construction, external cladding, window, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, application of weather barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly. Include building corner condition.
   2. Locate mockup where directed.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not store near heat source or open flame.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.08 WARRANTY

A. Manufacturer's Product Warranty: To repair or replace weather barrier product that fails in materials within specified warranty period.
   1. Warranty Period: 10 years from date of purchase.

B. Manufacturer's Product and Labor Warranty: Manufacturer agrees to repair or replace weather barrier that fails in materials within specified warranty period, including removal and replacement of affected construction up to manufacturer's limits.
   1. Warranty Period: 10 years from date of purchase.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Source Limitations: Obtain weather barrier assembly components, including weather barrier flashing and foam insulation from same manufacturer as weather barrier or manufacturer approved by weather barrier manufacturer.

B. Performance Requirements: Installed weather barrier and accessories shall withstand specified wind pressures, liquid water penetration, and water vapor pressures without failure due to defective manufacture of products.

C. Air Barrier:
   1. At mechanically attached siding: On outside surface of sheathing of exterior walls use air barrier sheet, mechanically fastened type.

2.02 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Mechanically Fastened:
   1. System Description, Single-Layer Weather Barrier: Single-layer weather barrier, including flashing and sealing of penetrations and seams.
   2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
   3. Water Vapor Permeance: 15 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   4. Water Penetration Resistance: Withstand a water head of 21 inches, minimum, for minimum of 5 hours, when tested in accordance with AATCC Test Method 127.
   5. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 180 days of weather exposure.
   6. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 50 or less, when tested in accordance with ASTM E84.
   7. Seam and Perimeter Tape: Polyethylene self adhering type, mesh reinforced, 2 inches wide, compatible with sheet material; unless otherwise specified.
   8. Manufacturers:
      a. DuPont Building Innovations; Tyvek CommercialWrap, Tyvek Wrap Caps, Tyvek Tape, and Tyvek Commercial Sealant: www.dupont.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 FLASHING AND ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Weather Barrier Flashing: Flexible composite flashing material with butyl-based adhesive layer as recommended by weather barrier manufacturer.
   1. Conformability: Able to create a seamless sill pan extending up the jambs without cuts, patches, or fasteners.
   2. Water Penetration: No leakage at 15 psf (720 Pa) per ASTM E331.
   3. Low Temperature Adhesion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm) at 25 deg F (minus 4 deg C) as Class A (without primer use).

4. Adhesion After Water Immersion: Exceeds minimum value of 1.5 lb./in. (0.26N/mm), after AAMA 800, Sections 2.4.1.3.1/2.4.1.4.3, Test B.
5. Products:
    a. DuPont Building Innovations; FlexWrap.
    b. For sealing penetrations: DuPont Building Innovations; FlexWrap EZ
    c. For window and door openings: DuPont Building Innovations; StraightFlash
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
1. Thickness: 40 mil, 0.040 inch, nominal.
2. Manufacturers:
    a. Carlisle Coatings and Waterproofing, Inc.; CCW-705 TFW: www.carlisle-ccw.com.
    b. Intertape Polymer Group, Inc; NovaFlash SA Universal Self-Adhered Flashing (25 mil): www.itape.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

D. Fluid-Applied Flashing: Trowel or brush applied, non-water soluble, single component, silyl terminated polyether technology (STPE), vapor permeable, flashing material.
1. VOC Content: ASTM C1250, less than 2 percent by weight and between 25 to 30 g/L.
2. Water Vapor Transmission: ASTM E96, Method B, greater than 20 perms (1100 ng/Pa x s x sq. m) at 25 mils (0.635 mm) thick.
3. Minimum Tensile Strength: ASTM D412, 165 lb/sq. ft. (1140 kPa).
4. Minimum Elongation at Break: ASTM D412; 380 percent.
5. Products:
    a. DuPont Building Innovations; Tyvek Fluid Applied Flashing & Joint Compound.
    b. Substitutions: See Section 01 6000 - Product Requirements.

E. Transition Membrane for sheathing with integral weather barrier: Self-adhering flexible membrane:
1. Georgia Pacific LLC; DensDefy Transition Membrane: www.gpgypsum.com.

F. Thinners and Cleaners: As recommended by material manufacturer.

G. Primers (for surface preparation): Required and as recommended by manufacturer.
1. Synthetic rubber-based product; spray applied, that strengthens adhesive bond at low temperature applications between weather barrier products and common building sheathing materials.
    a. Peel Adhesion Test: Passes in accordance with ASTM D3330, Test Method F.
    b. Chemical Compatibility: Pass; AAMA 713.
    c. Flame Spread Index: 5; ASTM E84.
    d. Smoke Development Index: 0; ASTM E84.

H. Closed-Cell Polyurethane Foam Insulation: Low-pressure, low-expansion, single-component polyurethane foam, with maximum flame-spread and smoke-developed indexes of 15 and 25, respectively, per ASTM E84.

I. Fasteners: Weather barrier manufacturer's recommended fasteners.
1. Type: Self-gasketing washers, pneumatically or hand-applied fasteners with 1-inch (25-mm) diameter, high-density polyethylene cap washers with UV inhibitors.
2. Products:
    a. DuPont Building Innovations; Tyvek Wrap Caps.
    b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements. Verify that surfaces and conditions are ready to accept the work of this section.

1. Verify that rough sill framing for doors and windows is sloped downwards towards the exterior and is level across width of the opening.
2. Verify that surfaces to receive weather barrier flashing are clean, dry, and free of frost.

B. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions. Coordinate installation with products installed in openings and penetrations.

B. Air Barriers & Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Mechanically Fastened Sheets - On Exterior:
1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
2. Overlap seams as recommended by manufacturer but at least 6 inches.
3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
6. Where stud framing rests on concrete or masonry, extend lower edge of sheet at least 4 inches below bottom of framing and seal to foundation with sealant or prime surface and apply self adhesive flashing.
7. Install water-resistive barrier over jamb flashings.
8. Install air barrier and vapor retarder underneath the jamb flashings.
9. Install head flashings under weather barrier.
10. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

D. Self-Adhered Sheets and membranes:
1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Clean substrate and apply primer to surface.
3. Lap sheets shingle-fashion to shed water and seal laps air tight.
4. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
5. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
6. At wide joints, provide extra flexible membrane allowing joint movement.

E. Fluid Coatings (Spray or Roll Applied):
1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
3. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch; use sheet seal to join to adjacent construction, seal air tight with sealant.
4. Use flashing to seal to adjacent construction and to bridge joints.

F. Openings and Penetrations in Exterior Weather Barriers:
   1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange. Install weather barrier into opening beyond the inside face of opening frame. Coordinate depth with opening unit.
   3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
   4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
   5. At interior face of openings, seal gap between opening unit frame and rough framing, flashing around opening perimeter using joint sealant over backer rod and sealed directly to the weather barrier.
   6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.
   7. Fastener penetrations: Apply fluid sealant at pentrations through weather barrier layer to at attachment of framing, furring, boards, etc to keep cohesiveness of weather barrier system maintained. Blind seals are prohibited.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Take digital photographs of each portion of the installation prior to covering up.
   1. Photograph each penetration through weather barrier prior to concealing from view.

3.05 CLEANING AND PROTECTION

A. Immediately remove release paper and scrap from work area and properly dispose of material.

B. Protect installed weather barrier from the following:
   1. Damage from cladding, structure, or a component of the structure (for example, window, door, or wall system).
   2. Contamination from building site chemicals, premature deterioration of building materials, or nonstandard use or application of products.
   3. Foreign objects or agents, including the use of materials incompatible with weather barrier products.
   4. UV exposure in excess of products' stated limits.

C. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 3113
ASPHALT SHINGLES

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Asphalt shingle roofing with underlayments installed on sloped roof sheathing.

B. Flexible sheet membranes for eave protection, underlayment, and valley protection.

C. Associated metal flashings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

C. ASTM D3161/D3161M - Standard Test Method for Wind-Resistance of Steep Slope Roofing Products (Fan-Induced Method); 2016.

D. ASTM D3462/D3462M - Standard Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules; 2010a.

E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

F. ASTM D4869/D4869M - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing; 2015.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

H. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings; 2011.

I. ASTM F1667 - Standard Specification for Driven Fasteners: Nails, Spikes, and Staples; 2013.

J. ICC-ES AC188 - Acceptance Criteria for Roof Underlayments; 2012.

K. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating material characteristics and performance criteria.

C. Shop Drawings: For metal flashings, indicate specially configured metal flashings, jointing methods and locations, fastening methods and locations, and installation details.

D. Samples: Submit two samples of each shingle color indicating color range and finish texture/pattern ; for color selection.

E. Manufacturer's Installation Instructions: Indicate installation criteria and procedures.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Products are Required to Comply with Fire Resistance Criteria: UL (DIR) listed and labeled.

1.05 MOCK-UP

A. Provide mock-up of 10 sq ft, including protection membrane, underlayment, shingles, and associated flashings.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Do not install shingles or eave protection membrane when surface temperatures are below 45 degrees F.

1.07 WARRANTY

A. Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace asphalt shingles that fail in materials or workmanship within specified warranty period.
   1. Material Warranty Period: 30 years from the date of Substantial Completion.
   2. Algae-Discoloration Warranty Period: Shingles will not discolor 10 years from date of Substantial Completion.
   3. Wind Damage Warranty: Limited Warranty against damage from wind up to 110 mph.

B. Installers Warranty: Provided warranty in which installer agrees to repair and replace components of the asphalt shingle roofing system that fail in materials or workmanship within 2 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Asphalt Shingles:
   1. GAF; Timberline HD Reflector Series: www.gaf.com/#sle.
   2. Owens Corning Corp; ____: www.owenscorning.com/#sle.
   3. Certainteed Corporation: www.certainteed.com
   4. Tamko Roofing Products: www.tanko.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ASPHALT SHINGLES

A. Asphalt Shingles: Asphalt-coated glass felt, mineral granule surfaced, complying with ASTM D3462/D3462M.
   1. Fire Resistance: Class A, complying with ASTM E108.
   2. Wind Resistance: Class A, when tested in accordance with ASTM D3161/D3161M.
   3. Warranted Wind Speed: 110 mph.
   4. Algae Resistant; granules treated to resist algae discoloration.
   5. Weight: 90 lb/100 sq ft.
   6. Self-sealing type.
   7. Style: Laminated overlay (architectural shingles).
   8. Color: As selected by Architect from Manufacturer's full color range.

2.03 SHEET MATERIALS

A. Protection Membrane (Eave Protection, Ice barrier): Self-adhering polymer-modified asphalt sheet complying with ASTM D1970; 40 mil total thickness; with strippable treated release paper and polyethylene sheet top surface.
   1. Manufacturers:
      a. GAF; Storm Guard: www.gaf.com
      b. Owen Cornings; WeatherLock Mat Self-Sealing Ice & Water Barrier: www.owencornings.com.
      c. CertainTeed; Winter Guard Granular: www.certainteed.com.
      d. Grace Construction Products; Grace Ice & Water Shield : http://gcpat.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Underlayment (Standard for Entire roof surface): Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; 22 mil total thickness; with strippable release film and woven polypropylene sheet top surface.
   1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
   2. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
   3. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.

4. Water Vapor Permeance: 0.067 perm, when tested in accordance with ASTM E96/E96M, Procedure A (desiccant method).
5. Liquid Water Transmission: Passes ASTM D4869/D4869M.
6. Manufacturers:
    a. System Components Corporation, Inc; FelTex SA300: www.systemcomponents.net/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Roofing Nails: Standard round wire shingle type, galvanized steel, stainless steel, aluminum roofing nails, or copper roofing nails, minimum 3/8 inch head diameter, 10 gage, 0.1019 inch nail shank diameter, 3/4 inch long or sufficient length to penetrate through roof sheathing or decking and complying with ASTM F1667.

B. Plastic Cement: ASTM D4586/D4586M, asphalt roof cement.

C. Lap Cement: Fibrated cutback asphalt type, recommended for use in application of underlayment, free of toxic solvents.

D. Ridge and Hip Vents: Plastic, extruded with vent openings that do not permit direct water or weather entry; flanged to receive shingles. Hip vents installed must be warranted for use at Hip locations.
1. Lomanco; OmniRidge Model LOR-30: www.lomanco.com.
2. GAF; Cobra Ridge Vent 3: www.gaf.com
3. GAF; Cobra Hip Vent: www.gaf.com
4. Air Vent Inc; Hip Ridge Vent: www.airvent.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.05 METAL FLASHINGS

A. Metal Flashings: Provide sheet metal eave edge, open valley flashing, chimney flashing, dormer flashing, other flashing indicated, and drip edge.

B. Flashing and Sheet Metals: See Section 07 6200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

B. Verify that roof deck is of sufficient thickness to accept fasteners.

C. Verify that roof penetrations and plumbing stacks are in place and flashed to deck surface.

D. Verify roof openings are correctly framed.

E. Verify deck surfaces are dry, free of ridges, warps, or voids.

3.02 PREPARATION

A. Seal roof deck joints wider than 1/16 inch as recommended by shingle manufacturer.

B. At areas where protection membrane is to be adhered to substrate, fill knot holes and surface cracks with latex filler.

C. Broom clean deck surfaces before installing underlayment or protection membrane.

D. Install eave edge flashings tight with fascia boards, weather lap joints 2 inches and seal with plastic cement, and secure flange with nails spaced ____ inches on center.

3.03 INSTALLATION - PROTECTION MEMBRANE

A. Install protection membrane from eave edge to minimum 4 ft up-slope beyond interior face of exterior wall.

B. Install protection membrane in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

C. At exposed valleys: Install one layer of protection membrane, 36 inches wide centered over open valley. Weather lap edges 6 inches minimum.

D. Install protection membrane, minimum 18" wide, centered over intersecting planes of roof surfaces, vertical protrusions, and plane terminations such as rakes, hips, dormers, wall intersection, etc.

3.04 INSTALLATION - UNDERLAYMENT

A. At Roof Slopes Up to 4:12 : Install two layers of underlayment perpendicular to slope of roof over area not protected by eave protection, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place.

B. At Roof Slopes Greater Than 4:12 : Install underlayment perpendicular to slope of roof, with ends and edges weather lapped minimum 4 inches. Stagger end laps of each consecutive layer. Nail in place. Weather lap minimum 4 inches over protection membranes.

C. Weather lap and seal watertight with plastic cement any items projecting through or mounted on roof.

3.05 INSTALLATION - METAL FLASHING AND ACCESSORIES

A. Install flashings in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Weather lap joints minimum 2 inches and seal weather tight with plastic cement.

C. Secure in place with nails at ____ inches on center, and conceal fastenings.

D. Install sheet metal flashings at perimeters of all valleys, crickets, chimney, roof curbs and other similar penetrations.

1. At Exposed Valleys: Install one layer of sheet metal flashing, minimum [18] inches wide, centered over open valley and crimped to guide water. Weather lap joints minimum 2 inch wide band of lap cement along each edge of first, press roll roofing into cement, and nail in place minimum 18 inches on center, 1 inch from edges.

E. Provide metal drip edges at fascia boards.

F. Items Projecting Through or Mounted on Roofing: Flash and seal weather tight with plastic cement.

3.06 INSTALLATION - SHINGLES

A. Install shingles in accordance with manufacturer's instructions manufacturer's instructions and NRCA (RM) applicable requirements.

1. Fasten individual shingles using two nails per shingle, or as required by manufacturer and local building code, whichever is greater.
2. Fasten strip shingles using four nails per strip, or as required by manufacturer and local building code, whichever is greater.

B. Place shingles in straight coursing pattern with 5 inch weather exposure to produce double thickness over full roof area, and provide double course of shingles at eaves.

C. Project first course of shingles 3/4 inch beyond fascia boards.

D. Extend shingles 1/2 inch beyond face of gable edge fascia boards.

E. Extend shingles on one slope across valley and fasten. Trim shingles from other slope 2 inches, or as detailed, from valley center line to achieve closed cut valley, concealing the valley protection.

F. Cap hips with individual shingles, maintaining 5 inch weather exposure, and place to avoid exposed nails.

G. After installation, place one daub of plastic cement, one inch diameter under each individual shingle tab exposed to weather, to prevent lifting.

H. Coordinate installation of roof mounted components or work projecting through roof with weather tight placement of counterflashings.

I. Complete installation to provide weather tight service.

3.07 PROTECTION

A. Do not permit traffic over finished roof surface.

END OF SECTION

SECTION 07 4623
WOOD SIDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board siding for walls.

B. Trim, flashings, accessories, and fastenings.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Weather barrier under siding.

B. Section 09 9113 - Exterior Painting: Prime and finish painting.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating materials.

C. Samples: Submit two samples 12 inch by 12 inch in size to applicator of finish paint for use in preparation of finish samples.

1.05 QUALITY ASSURANCE

A. Grade lumber in accordance with the following:
   1. Western Red Cedar: WCLIB (GR).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in ventilated areas with constant minimum temperature of 60 degrees F and maximum relative humidity of 55 percent.

PART 2 PRODUCTS

2.01 SIDING

A. Board Siding: Beveled, cedar, maximum moisture content of 10 percent.
   1. Size: 3/4- inch thick butt, 6- inch high nominal board with 4- inch to 4-3/4 inch exposure (varies).
   2. Surface Texture: Sanded.
   3. Preservative Treatment: Pressure treatment in accordance with AWPA U1, using non-discoloring water borne preservative.

2.02 ACCESSORIES

A. Preservative Treatment: Dip- or brush-type, non-discoloring.

B. Nails: Corrosion resistant type; non-staining, of size and strength to securely and rigidly retain the work ; prefinished to match siding finish.

C. Flashing: Galvanized steel, 28 gage, 0.0149 inch minimum base metal thickness.

D. Prime Paint: Latex base primer enamel. Comply with requirements in Section 09 9113 - Exterior Painting.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready to receive work.

B. Verify that weather barrier has been correctly and completely installed over substrate.

C. Do not begin until unacceptable conditions have been corrected.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Apply dip- or brush-type preservative to site-sawn ends of pressure preservative treated materials, and allow preservative to cure prior to erecting materials.

B. Prime paint surfaces in contact with cementitious materials.

C. Do not install materials until site pre-finishing is complete and dry.

3.03 INSTALLATION

A. Install siding in accordance with manufacturer's instructions.

B. Fasten siding in place, level and plumb.
   1. Arrange for orderly nailing pattern, blind nail except over trim.
   2. Install siding for natural shed of water.
   3. Position cut ends over bearing surfaces, and sand cut edges smooth and clean.

C. Install board siding using single course method with 4-inch to 4 3/4-inch exposure.
   1. Nail at 12 inches on center.
   2. Miter horizontal joints tight at 45 degrees, miter external and miter internal corners.

D. Install metal flashings at internal and external corners.

E. Touch-up, repair, or replace wood siding materials having damaged factory-applied finish; notify Architect of damaged materials, and confirm acceptable process prior to completion of this work.

F. Sand work smooth and set exposed nails and screws.

G. Prepare for site finishing specified in Section 09 9113.

3.04 TOLERANCES

A. Maximum Variation From Plumb and Level: 1/4 inch per 10 feet.

B. Maximum Offset From Joint Alignment: 1/16 inch.

END OF SECTION

SECTION 07 5600
FLUID-APPLIED ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied roofing materials.

B. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2025.

B. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011.

C. ASTM D312/D312M - Standard Specification for Asphalt Used in Roofing; 2015.

D. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2012).

E. ASTM D5147/D5147M - Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material; 2018 (Reapproved 2024).

F. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2021.

G. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's data for membrane and accessory materials.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Installation Instructions: Include standard installation instructions, acceptable installation temperature range, and procedures for unusual perimeter conditions.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of fluid-applied roofing or waterproofing systems.
   1. Three years' documented experience manufacturing type of product specified.

B. Installer Qualifications: Company specializing in installation of fluid-applied roofing or waterproofing systems.
   1. Five years of documented experience.

1.05 MOCK-UPS

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Construct mock-up consisting of specified roofing materials, including internal and external corners, base flashings, and steel tube post flashing similar to those included as part of this work.
   1. Locate where directed.

2. Mock-up may remain as part of work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

B. Store materials in weather protected environment, clear of ground and moisture.

C. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

B. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for additional warranty requirements.

B. Provide 20-year manufacturer warranty that roofing membrane will not crack, split, or flake under normal weather conditions and will not fail to resist penetration of water during that time period.
   1. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Roofing:
   1. Siplast Inc.: Parapro PMMA Liquid Roof Membrane and Flashing System; www.siplast.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING MEMBRANE SHEET MATERIALS

A. Fluid-Applied Roofing: White, cold-applied; multi-component; polymethyl-methacrylate-based (PMMA), approved by manufacturer for permanent exposure to weather and sunlight.
   1. Dry Film Thickness (DFT): 90 mils, 0.090 inch, minimum, applied in two coats with reinforcing fabric between each coat.

B. Base Ply: ASTM D6163/D6163M , Type I, Grade S homogenous membrane with a glass-fiber reinforcing mat impregnated/saturated and coated each side with manufacturer's standard adhesive. The base ply shall be surfaced with a factory-applied acrlic coating.
   1. Thickness (avg): 91 mils (2.3 mm).
   2. Physical and mechanical properties complying with ASTM D5147/D5147M .

C. Resin for Finish Ply Membrane Construction: Multi-component, fast-curing, flexible PMMA-based resin for use in combination with fleece fabric to form a monolithic, reinforced roofing membrane.
   1. Thickness (avg): 90 mils (2.3 mm) at 0.31 kg/ft² (3.3 kg/m²) coverage rate; ASTM D5147/D5147M

D. Fleece for Membrane Reinforcement: Non-woven, needle-punched polyester fabric reinforcement as supplied by the membrane system manufacturer.

2.03 BASE FLASHING SHEET MATERIALS

A. Base Flashing Sheet Materials: Stripping and flashing reinforcing ply, ASTM D6163/D6163M , Type I, Grade S homogenous membrane with glass-fiber reinforcing mat impregnated/saturated and coated each side with manufacturer's standard self-adhesive to provide full adhesion to the total surface area of the substrate. Supplied by the membrane system manufacturer.

B. Liquid Flashing System: Catalyzed PMMA-based membrane fully reinforced with a non-woven polyester fleece that is installed over a prepared or primed substrate as supplied by the membrane system manufacturer.

C. Flexible Flashing Sheet: Neoprene or other elastic type sheets approved by roofing membrane manufacturer.

2.04 BITUMIOUS MEMBRANE PRIMERS

A. Low VOC Asphalt Primer: Primer shall meet ASTM D41/D41M criteria.

B. Primer for Self-Adhesive Membranes: Primer for self-adhesive membranes shall be a single component, water-based resinous primer formulated to condition masonry, wood, plywood, concrete, asphaltic, and gypsum surfaces to facilitate adhesion of self-adhesive membranes.

2.05 AUXILIARY ROOFING MATERIALS

A. Roofing Asphalt: ASTM D312/D312M , Type III or IV.

B. Membrane Adhesive: A single-component, moisture curing, low-odor adhesive designed for application of the specified roof membrane system.

C. Flashing Cement: A single-component, moisture curing, low-odor adhesive formulated in a grade for application of flashing materials.

D. Sealant: A moisture-curing, self-leveling or non-slumping elastomeric sealant designed for roofing applications

E. Base Sheet Fasteners for Wood/Plywood Decks: 12-gauge, spiral or annular threaded shank, zinc-coated steel roofing fastener having a min. 1-inch metallic head.

F. Base Sheet for Nailable Substrates: Fiberglass reinforced, asphalt coated sheet with a polyolefin film backing, having a minimum weight of 20 lb/sq; conforming to ASTM D4601/D4601M , Type II.

G. Substrate Board/ Thermal Barrier: panel composed of a gypsum based, non-structural water resistant core material integrally bonded with fiberglass mats on both sides.
   1. Georgia Pacific Corp: DensDeck Gypsum Roof Board or similar.

2.06 ROOF INSULATION:

A. General:
   1. Insulation shall be approved in writing by the insulation manufacturer for intended use and for use with the specified roof assembly.
   2. Maintain a maximum panel size of 4 feet by 4 feet where polyisocyanurate / fiberboard insulation is specified to be installed in insulation adhesive or hot asphalt.
   3. Install only as much insulation as can be made watertight during the same work day.

B. Tapered Polyisocyanurate Board Insulation (organic paper facer): Closed cell, rigid polyisocyanurate foam core material, integrally laminated between glass fiber reinforced organic facers, complywing with ASTM C1289 , Type II, Class 1, Grade 2.
   1. The tapered system shall incorporate fill panels of a nominal thickness and provide for a roof slope of 1/4 inch per foot.

C. Insulation Accessories:
   1. Insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for ridging.
   2. Insulation Fasteners for Wood/Plywood Decks:
      a. Insulation mechanical fasteners shall be a fluorocarbon coated screw type roofing fastener having a minimum 0.220 inch thread diameter.
      b. Plates used in conjunction with the fastener shall be a metal type having a minimum 3 inch diameter, as supplied by the fastener manufacturer..
      c. The fastener shall conform meet or exceed FM 4470 and when subjected to 30 Kesternich cycles, show less than 15% red rust.

3. Insulation Adhesive: Single or dual component low-rise polyurethane foam adhesive designed specifically for the adhesion of roof insulation to substrate, as well as subsequent layers of insulation.
4. Tapered Edge Strips:
    a. A tapered panel composed of expanded volcanic minerals combined with waterproofing binders.
    b. The top surface shall be pre-treated with an asphalt based coating.
    c. The panels shall have a dimension sufficient to provide for a smooth transition and provide proper support for the membrane layer or subsequent layer of insulation when there are transitions of 1/4 inch or greater.

2.07 RESIN ACCESSORIES

A. Cleaning Solution/Solvent: A clear solvent used to clean and prepare transition areas of in-place catalyzed resin to receive subsequent coats of resin and to clean substrate materials to receive resin.

B. Preparation Paste: A PMMA-based paste used for remediation of depressions in substrate surfaces or other irregularities.

C. Repair Mortar: A two-component, PMMA-based, aggregate filled mortar used for patching concrete substrates.

D. Thixotropic Agent: A liquid additive used to increase the viscosity of the PMMA-based resin products, allowing the resins to be applied over sloped substrates.

E. Color Finish Resin: A pigmented, PMMA-based resin for used to provide a color finish for both field and flashing membranes.

F. Catalyst: A peroxide-based reactive agent used to induce curing of PMMA-based resins.

G. Primers for PMMA Resin-based Roof Membrane and Flashing:
    1. Primer for Wood, Plywood and Rigid Insulation, Masonry and Vertical Concrete Substrates: A fast-curing PMMA-based primer for use in over wood, plywood and rigid insulation substrates.

2.08 ACCESORIES

A. Ceramic Granule Anti-Skid Surfacing: No. 11 grade specification ceramic granules suitable for broadcast into a PMMA-based resin wearing layer.

B. Joint Tape: A thermoplastic/rubber based sheet having a woven polyester backing used to treat joints between rigid insulation, flashing substrate panels and joints at cover plates used over sheet metal components. The tape shall have a minimum width of 4 inches.

C. Spray Primer for Stainless Steel, Aluminum and Copper Substrates: An enamel spray primer for metal substrates to receive PMMA-based flashings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to starting this work.

B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of roofing system.

C. Verify that substrate surfaces are smooth, free of honeycombs or pitting, and not detrimental to full contact bond of roofing materials.

D. Verify that roof openings, curbs, and items that penetrate surfaces to receive roofing materials are securely and properly installed.

3.02 PREPARATION

A. Clean and prepare surfaces to receive roofing in accordance with manufacturer's instructions and recommendations. Sweep or vacuum all surfaces, removing all loose aggregate and foreign substances prior to commencement of roofing.

B. Seal cracks and non-moving open joints less than 1/2 inch wide with sealant using methods recommended by roofing and sealant manufacturers; do not seal expansion joints or moving joints of any width.

C. Install cant strips at inside corners, where indicated and where required by roofing manufacturer.

D. Protect adjacent surfaces not designated to receive roofing.

E. Primer for Self-Adhesive Flashing Reinforcing Ply: Apply the specified tacky primer by roller or spray in an even film. Refer to the manufacturer's literature for the approved rate of application over various substrate types. Allow the primer to dry until it leaves a slightly sticky surface without transfer when touched. Cutting or alteration of the primer is not permitted.

F. Preparation of Wood/Plywood Flashing Substrates to receive Resin: Prime wood/plywood surfaces to receive the specified flashing system with the specified PMMA-based primer at the rate specified by the resin manufacturer and allow primer to cure. Tape the joints between plywood or wood panels using gaffer's tape prior to application of the lashing system

3.03 INSTALLATION, GENERAL

A. Install tapered insulation and fluid-applied roofing in accordance with manufacturer's instructions and recommendations, to specified minimum thickness.

B. Apply roofing materials to surfaces that are acceptable to manufacturer.

C. Adhesive Application: Apply membrane cold adhesive by roller, squeegee or spray unit in a smooth, even, continuous layer without breaks or voids. Utilize an application rate for each ply as published by the roof membrane manufacturer. Double the adhesive application rate at the end laps of granule surfaced sheets. Where solvent-based adhesive is applied, refer to the manufacturer's inter-ply flashing detail at the locations that are to receive the specified catalyzed acrylic resin primer/flashing system. Cutting or alteration of the adhesive is not permitted

D. General Appearance: Ensure that the finished roofing application has an aesthetically pleasing overall appearance and is acceptable to the Owner.

E. Installations Over Sealant-Filled Joints: Install an extra coating of roofing material over joints at least 6 inches on each side of joint.

F. Penetrations: Unless otherwise indicated on drawings, or recommended by roofing manufacturer, seal flexible flashing sheet around penetrations and to roofing substrate prior to installation of roofing material, embedding flashing sheet in one coat of roofing material.

G. Embedded Flexible Flashing Sheet: Apply full thickness of roofing material over exposed flashing sheet.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Upon completion of horizontal fluid-applied roofing material installation, install dam at perimeter of installation area in preparation for flood testing.

C. Flood area to a minimum depth of 1 inch with clean water, and after 72 hours, inspect for leaks.

D. If leaking is found, remove water, repair leaking areas with new roofing materials as directed by Architect, and repeat flood test. Repair damages to building related to roof test leakage.

E. When area is confirmed to be watertight, drain water and remove dam materials.

3.05 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must proceed over installed roofing materials, protect surfaces using durable materials acceptable to roofing material manufacturer.

END OF SECTION

SECTION 07 6100
SHEET METAL ROOFING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Architectural roofing system of preformed metal panels with underlayment on roof sheathing.

B. Metal roofing accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 1500 - Wood Decking: Roof sheathing.

B. Section 07 9200 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2025.

E. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2025.

G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

H. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2012).

I. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference; 1995 (Reapproved 2011).

J. ASTM E1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems; 2011.

K. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements as referenced in this document.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Manufacturer Warranty:
   1. Material Warranty: Provide manufacturer's No Dollar Limit (NDL) warranty for weathertightness of roofing system, include agreement to repair and/or replace roofing that fails to keep out water within specified warranty period of 20 years from date of Substantial Completion.
   2. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of 20 year period from date of Substantial Completion.

C. Installer's Warranty: Provide warranty in which installer agrees to repair and replace components of the roofing system that fail in materials or workmanship within 2 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Roof Panels:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. MBCI Inc.; www.mbci.com.
   3. Petersen Aluminum Corporation; Snap-Clad Panel: www.pac-clad.com/#sle.
   4. Architectural Building Components: www.archmetalroof.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roofing: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Aluminum Panels:
      a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
      b. Thickness: Minimum 20 gage (0.032 inch).
   2. Profile: Standing seam, with minimum 1.5 inch seam height; concealed fastener system for field seaming with special tool.

3. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
4. Wind Uplift: Class 90 wind uplift resistance of UL 580.
5. Texture: Smooth, with intermediate ribs for added stiffness.
6. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
7. Width: Maximum panel coverage of 18 inches.

2.03 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, wind speed, including anticipated thermal movement.

2.04 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gage steel framing incidental to structural supports; fabricated from steel sheet.

B. Framing Material: ASTM A 1011/A 1011M, Designation SS steel sheet.

C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.

2.05 FABRICATION

A. Panels: Provide factory or field fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.06 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss as selected by Architect from manufacturer’s standard line.

B. Solar reflectance index (SRI): 29 minimum.

C. Provide removable protective film on surface of panel.

2.07 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, and edge drips of the same material, minimum thickness and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel. Refer to Section 07 6200.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Surface Mounted Snow Guards: Provide one, snow guard, per panel and stagger 18 inches vertically every other panel.

D. Sealants (as specified in Section 07 9200):
1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane. Must cure to a rubber-like consistency.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

E. Underlayment for Wood Substrate: ASTM D226/D226M roofing felt, perforated type; covered by water-resistant rosin-sized building paper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.03 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Install roofing felt and building paper slip sheet on roof deck before installing preformed metal roof panels. Secure by methods acceptable to roof panel manufacturer, minimizing use of metal fasteners. Apply from eaves to ridge in shingle fashion, overlapping horizontal joints a minimum of 2 inches and side and end laps a minimum of 3 inches. Offset seams in building paper and seams in roofing felt.

D. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Provide sealant tape or other approved joint sealer at lapped panel joints.
   3. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION V.20

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 07 3113 - Asphalt Shingles: Non-metallic flashings associated with shingle roofing.

B. Section 07 6105 - Sheet Metal Roofing.

C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

F. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2009.

G. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

H. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

I. CDA A4050 - Copper in Architecture - Handbook; current edition.

J. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

K. Copper and Common Sense - Revere Copper Products, latest edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, material thickness, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit one sample, 12- inch long minimum, illustrating material and fabrication details of one typical flashing profile.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
   1. Maintain one copy of each document on site.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Reference roofing specifications for warranty limits and terms that apply. Products or fabrications installed with the roofing system to contain manufacturer's warranty as specified in roofing specification section.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Copper: ASTM B370, cold rolled 16 oz/sq ft (24 gage) (0.0216 inch) thick; natural finish.

2.02 FABRICATION

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Form sections true to shape, accurate in size, square, and free from distortion or defects. Fabricate metal flashing and trim without excessive oil canning, buckling and tool marks, true to line and levels indicated with exposed edges folded back to form hems.

D. Fabricate cleats of same material as sheet, minimum 2- inches wide, interlocking with sheet.

E. Form pieces in longest possible lengths to a maximum of 15 feet unless specifically approved otherwise by Architect. Treat seams between two different pieces with flat-lock seams at non-moving joints, unless otherwise indicated. At moving seams, use seated, lapped, bayonet type or interlocking hooked seams.

F. Fabricate sheet metal flashing and trim without excessive oil canning, buckling and tool marks, true to line and levels indicated with exposed edges folded back to form hems.

G. All exposed edges to be folded back with hem of 1/2 inch; miter and seam corners.

H. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

I. Tin edges of copper sheet to be soldered; solder shop formed metal joints, and after soldering, remove flux, wipe and wash solder joints clean; provide weathertight joints.

J. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

K. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

L. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

M. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joint of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints. Provide for expansion no more than in 40 feet long sections.

N. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

O. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than the thickness of the metal being secured.

2.03 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA Architectural Sheet Metal Manual, Semi-circular profile - 5-inch.
   1. Lengths to be continuous no longer than 40 foot sections.
   2. Joints to be flat-lock seam with sealant.
   3. Corners to be factory mitered and welded.
   4. Expansion joints to have end of each gutter capped, allow for 1" of expansion between gutters and covered with coverplate.

B. Downspouts: Round profile 4" wide x 3" deep or unless indicated otherwise.
   1. Same as Gutters except: Vertical seams to be Double Corner Seam with sealant.

C. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA requirements with Stainless Steel or Aluminum fasteners.
   2. Gutter Supports: Straps of size per SMACNA requirements, but not less than twice the thickness of the gutter material.
   3. Downspout Supports: Straps.
   4. Valley Diverters: 12-inch x 12-inch minimum at valley, 0.040 inch thick minimum. Extend a minimum of 4" above eave edge.

D. Seal metal joints, see Joint Sealants.

2.04 ACCESSORIES

A. Fasteners: Copper or Stainless Steel.

B. Slip Sheet: Rosin sized building paper.

C. Primer: Zinc chromate type, used where sheet metal has been cut.

D. Protective Backing Paint: Zinc molybdate alkyd.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION GENERAL

A. Conform to Drawings and details as appropriate from the SMACNA Architectural Sheet Metal Manual, and Copper and Common Sense.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Secure gutters and downspouts in place with concealed fasteners. Pop-rivets are not concealed Fasteners.

F. Slope gutters 1/4 inch per 10 feet, minimum.

3.04 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored straps spaced not more than 24 inches apart. Provide enclosures and seal watertight with sealant. Slope gutters 1/4 inch per 10 feet minimum to downspouts.
   1. Fasten gutter spacers to front and back of gutter.
   2. Loosely lock straps to front gutter bead and anchor to roof deck.
   3. Anchor and loosely lock back edge of gutter to continuous eave or apron flashing.
   4. Anchor back of gutter that extends onto roof deck with cleats spaces not more than 24 inches apart.
   5. Install gutter with expansion joints at locations indicated or not exceeding 40 feet apart.

C. Downspouts: Join sections with 1-1/2" telescoping joints.
   1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches o.c. in between.
   2. Secure downspouts to building with straps and mechanical fasteners. Do not use pop-rivets.
   3. Provide elbows at base of downspout to direct water away from building.

3.05 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, an level as indicated. Install work with laps, joints ans seams that will be permanently watertight.

B. Roof Edge Flashings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Comply with installation requirements of roofing manufacturer regarding spacing of anchors below membrane flashing in field of roof.
   1. Install flexible flashing covering entire substrate beneath coping; not required where roofing material extends beneath coping. Seal perimeters against weather barrier and/or roofing.
   2. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at minimum 8-inch centers.

C. Pipe or Post Counterflashing: Install counter flashing umbrella with close -fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches of base of flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counter flashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant.
   1. Secure in a waterproof manner by means of anchor and washer at 36-inch centers.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof.

3.06 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetration moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors and louvers.

B. Opening Flashings in Frame Construction: Install continuous head, sill and similar flashings to extend beyond wall openings a minimum of 4 inches or as indicated.

C. Install reglets per manufacturer's recommendations.

3.07 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.08 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for field inspection requirements.

B. Inspection will involve periodic surveillance of work by Architect during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 7200
ROOF ACCESSORIES

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Roof penetrations mounting curbs.

B. Rooftop mechanical screen wall.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry

B. Section 07 5400 - Thermoplastic Membrane Roofing

C. Section 07 6200 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout drawings developed for this project. Include dimensioned location and number for each type of roof accessory.
   1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
   2. Rooftop mechanical screen wall:
      a. Include complete detailed layout of all panels and posts.
      b. Submittal shall include plan layout, elevations, section views, and details of post connections to structure.
      c. Submit design calculations for loadings and spacings.

D. Samples for Color Selection: For rooftop mechanical screen wall, submit color chips representing manufacturer's full range of available colors and finishes for Architect selection.

E. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 COORDINATION

A. Coordinate Work with installation of roofing materials to avoid damage to installed insulation and membrane materials. Comply with requirements in Section 07 5400 - Thermoplastic Membrane Roofing.

1.06 PERFORMANCE REQUIREMENTS

A. General: Design all materials, assembly and attachments to resist snow, wind, suction and uplift loading at any point without damage.

B. Design Loads: Comply with Building Code for site location and building height. Comply with ASCE 7, latest version for minimum design loads.

C. Structural Performance: Provide product and installation capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under condition indicated.
   1. Uniform pressure of 30 lbf/sq. ft. acting inward or outward
   2. Thermal Movements resulting from a temperature change (range) of 120 deg F ambient and 180 deg F material surfaces.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.08 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Rooftop Mechanical Screen Manufacturer's Warranty: Provide standard warranty that product will be free from defects in materials and workmanship, and manufacturer agrees to repair or replace defective components within specified warranty period of one year from Date of Substantial Completion.

C. Rooftop Mechanical Screen Manufacturer's Finish Warranty: Provide standard warranty that product finish will be free from failure of factory-applied exterior finish, and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, peeling, blistering or corrosion within specified warranty period of twenty years from Date of Substantial Completion.

D. Installer's Warranty: Provide warranty in which installer agrees to repair and replace components of this Section that fail in materials or workmanship within 2 years from the date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
   2. Sheet Metal Material:
      a. Aluminum: 0.080 inch minimum thickness, with 3003 alloy, and H14 temper.
   3. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
      a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
      b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
      c. Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
      d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
   4. Provide layouts and configurations indicated on drawings.

2.02 ROOFTOP MECHANICAL SCREEN WALL

A. Manufacturers
   1. PalmSHIELD Elite Screen System; www.palmshieldlouvers.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Louvered Mechanical Screen Wall: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated wind loading and thermally induced movement of roofing system. Comply with the following requirements:
   1. Description: Fencing system consisting of modular fence panels, containing horizontal louvers, fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts.
   2. Materials:
      a. Extruded Aluminum: ASTM B 221, Alloy 6063 – Temper T-6.
      b. Sheet Aluminum: ASTM B211, Alloy 6063 – Temper T6.
      c. Powder Coating Material Hardness: ASTM 3363 2H.
   3. Louver Panels:
      a. Panel Height: As shown on Drawings.
      b. Panel Width: As shown on Drawings. Do not exceed 6 linear feet.
      c. Fixed Louver Planks: Extruded aluminum.
         1) Size: Manufacturer's standard.
         2) Angle: 20-degree angle with 1/4-inch overlap.
      d. Vertical Framing: Tapered aluminum channel profiles, manufacturer's standard size.
      e. Horizontal Top Cap and Bottom Cap: Aluminum channels, manufacturer's standard size.
      f. Cross Bars: Aluminum flat bars, manufacturer's standard.
   4. Fence Posts: Extruded tubular aluminum sections with solid aluminum caps.
      a. Post size: Manufacturer's standard.
      b. Length: As shown on Drawings.
   5. Fittings and Accessories: Provide all anchors plates, anchor bolts, fasteners, fittings and accessories for a complete installation.
      a. Material: Stainless steel, type 304.
   6. Factory Finish:
      a. Polyester Powder Coating: Electrostatically applied, colored, polyester powder coating, heat-cured to chemically bond to metal substrate.
      b. Color: To be selected from manufacturer's full range.
      c. Minimum Hardness: Measured in accordance with ASTM D3363 2H.
      d. Direct Impact Resistance: Tested in accordance with ASTM D2794 to withstand 160 inch-pounds.
      e. Salt-spray Resistance: Tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95° F and 95% relative humidity. After 1,000 hours, no undercutting less than 3/16-inch.
      f. Weatherability: Tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted 45-degrees.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field verify that locations to receive Work are complete and provide level surface for installation. Variations in heights or slopes shall be shown on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION OF ROOF CURBS

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 INSTALLATION OF MECHANICAL SCREEN WALLS

A. Install screen wall in accordance with manufacturer’s installation instructions.

B. Install screen wall plumb and level. Posts are plated and mounted to top of surface.

C. Pre-drill all posts and panels as directed by manufacturer to support level installation.

D. Install fence posts as directed by manufacturer with provided anchor plates, anchor bolts and fittings.

E. Provide membrane flashing at each post location. See requirements in Section 07 5400 - Thermoplastic Membrane Roofing.

F. Secure screen panels to fence posts as directed by manufacturer with provided fittings.

G. Do not install bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

3.05 CLEANING

A. Clean installed work to like-new condition.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 8400
FIRESTOPPING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a.

E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

F. FM (AG) - FM Approval Guide; Current Edition.

G. ITS (DIR) - Directory of Listed Products; current edition.

H. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

I. UL (FRD) - Fire Resistance Directory; current edition.

J. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List firestopping test or design number and locations of all rated walls with type of fire stopping system proposed.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Certificate from authority having jurisdiction indicating approval of materials used.

G. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. Hilti, Inc; _____: www.us.hilti.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Prohibited Materials: Do not use any product that contains asbestos..

C. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

D. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

E. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

F. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

D. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the firestop systems.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 IDENTIFICATION AND DOCUMENTATION

A. The firestop contractor is to supply documentation for each single application addressed. This documentation is to identify each penetration and joint location on the entire project.

B. Copies of these documents are to be provided to the general contractor at the completion of the project.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2006 (Reapproved 2011).

B. ASTM C834 - Standard Specification for Latex Sealants; 2014.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2002 (Reapproved 2013).

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

J. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2005 (Reapproved 2010).

K. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

F. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.04 MOCK UP

A. Provide mock-up of sealant joints in conjunction with wall and air barrier system.

B. Construct mock-up with specified sealant types and with other components noted.

C. Locate where directed. Mockup may remain as part of the Work.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
      a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
      b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
   3. Field testing agency's qualifications.

E. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   3. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
   4. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
   5. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

F. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
   1. Sample: At least 18 inches long.
   2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
   3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

1.06 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.

2. Momentive Performance Materials, Inc (formerly GE Silicones): www.momentive.com.
3. Pecora Corporation: www.pecora.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
1. Dow Corning Corporation: www.dowcorning.com/construction/#sle.
2. Master Builders Solutions by BASF: www.master-builders-solutions.basf.us/en-us/#sle.
3. Pecora Corporation: www.pecora.com.
4. Sherwin-Williams Company: www.sherwin-williams.com.
5. Sika Corporation: www.usa-sika.com.
6. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
a. Wall expansion and control joints.
b. Joints between door, window, and other frames and adjacent construction.
c. Joints between different exposed materials.
d. Openings below ledge angles in masonry.
e. Other joints indicated below.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
a. Joints between door, window, and other frames and adjacent construction.
b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
c. Other joints indicated below.
3. Do not seal the following types of joints.
a. Intentional weepholes in masonry.
b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
d. Joints where installation of sealant is specified in another section.
e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing; Type H.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing; Type H.
3. Butt Joints in Exterior Metal Work and Siding: Acrylic Emulsion; Type G.
4. Joints between concrete panels and between panels of adjacent work:
5. Joints between masonry and cast stone: Type U with sand.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. Type ___ - In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
5. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 NONSAG JOINT SEALANTS

A. Type U-1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Color: Match adjacent finished surfaces.
   5. Cure Type: Single-component, neutral moisture curing.
   6. Service Temperature Range: Minus 20 to 180 degrees F.
   7. Manufacturers:
      a. Dow Chemical Company; DOWSIL 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Pecora Corporation: www.pecora.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Type U-2 - Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: Match adjacent finished surfaces.
   4. Cure Type: Single-component, neutral moisture curing
   5. Service Temperature Range: Minus 65 to 180 degrees F.
   6. Manufacturers:
      a. Dow Chemical Company; DOWSIL 999-A Building and Glazing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Pecora Corporation: www.pecora.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

C. Type E - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: White.
   2. Manufacturers:
      a. Pecora Corporation: www.pecora.com.

D. Type A - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com/#sle.
      c. BASF Corporation; MasterSeal NP1, One component polyurethane sealant. www.master-builders-solutions.basf.us
      d. Substitutions: See Section 01 6000 - Product Requirements.

E. Type J - Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers:
      a. Sika Corporation; Sikaflex-1a: www.usa-sika.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Type B - Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.

G. Type G - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces, Type OP (opaque).
   2. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Sherwin-Williams Company; 850A Acrylic Latex Caulk: www.sherwin-williams.com/#sle.
      c. Sherwin-Williams Company; 950A Siliconized Acrylic Latex Caulk: www.sherwin-williams.com/#sle.

H. Type C - Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
   1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Service Temperature Range: Minus 13 to 180 degrees F.
   4. Manufacturers:
      a. Sherwin-Williams Company; Storm Blaster All Season Sealant: www.sherwin-williams.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

I. Type H - Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
   1. Manufacturers:
      a. Pecora Corporation; Pecora BA-98 Non-Skinning Butyl Sealant: www.pecora.com/#sle.

2.04 SELF-LEVELING SEALANTS

A. Type F - Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
   3. Color: Grey.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers:
      a. Sherwin-Williams Company; Stampede 1SL Polyurethane Sealant: www.sherwin-williams.com/#sle.
      b. Sika Corporation; Sikaflex-1c SL: www.usa-sika.com/#sle.

B. Type P - Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic. Joint filler for areas to receive polished concrete finish. Confirm material with system manufacturer / installer.
   1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
   2. Color: To be selected by Architect from manufacturer's standard colors.
   3. Joint Width, Maximum: 3/4 inch.
   4. Manufacturers:
      a. ARDEX Engineered Cements; ARDEX ARDISEAL RAPID PLUS: www.ardexamericas.com/#sle.
      b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com/#sle.
      c. Nox-Crete Inc; DynaFlex JF-85: www.nox-crete.com/#sle.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
   1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
   2. Open Cell: 40 to 50 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

F. Sand: White or tan sand, selection based on field mockup.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

D. Repair destructive test location damage immediately after evaluation and recording of results.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Interior non-fire-rated doors and frames; hot-rolled steel.

B. Fire-rated hollow metal frames.

C. Steel door accessories, including glazing and sidelights and transoms.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants.

B. Section 08 1433 - Stile-and-Rail Wood Doors.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

E. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

I. ASTM E413 - Classification for Rating Sound Insulation; 2010.

J. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

L. ITS (DIR) - Directory of Listed Products; current edition.

M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

O. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

T. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, anchorage and fastening methods, and color charts for finishes.

C. Shop Drawings: Details of each opening, showing elevations, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Warranty documentation.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish. Ventilate canvas or plastic coverings to prevent humidity buildup.

C. Store in designated areas in an upright position on wood slats or on a dry floor in a manner that will prevent damage.

1.08 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for warranty requirements.

B. Manufacturer's Warranty: Provide manufacturer's standard limited warranty.
   1. Warranty Period for Steel Doors and Frames: 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames:
   1. Assa Abloy Ceco, Curries or Flemming; www.assaabloydss.com

2. Steelcraft, an Allegion brand; ____: www.allegion.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. Hot-Rolled Steel Doors and Frames:
1. Basis-of-Design: Hope's Windows Inc., Hope's Old World Suite series; www.hopeswindows.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Frames:
1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

2.03 STEEL DOORS AND FRAMES

A. Materials:
1. Heavy custom triple weatherstripped doors shall be manufactured from solid hot-rolled steel profiles.
a. Profiles made from steel with flanges rolled integrally at the mill.
b. Perimeter frames and ventilator profiles shall have glazing rebates providing an unobstructed glazing surface of at least 3/8".
c. Glazing rebate surfaces must be perpendicular to the web or stem of the profile. Applied glazing rebate extensions and rebate surfaces that are tapered will not be acceptable.
d. Combined weight of frame and ventilator profiles shall be a minimum of 3.98 pounds per lineal foot. Frame profile alone shall not weigh less than 1.70 pounds per lineal foot.
e. All steel profiles must be a minimum of 1-3/4″ in depth.
f. The frame and ventilator profiles shall have integral grooves located in the exterior and interior bedding contacts for the reception of triple weatherstripping.
g. Kickpanels shall be of composite construction.
h. Lockboxes and/or lockstiles shall be of composite construction.
2. Muntins: True divided lites.
a. Muntin shall be manufactured from solid hot-rolled steel, size to be determined by design.
b. Glazing rebate surfaces must be perpendicular to the stem of this profile. Rebate surfaces that are tapered will not be acceptable.
c. 7/8” arrow shaped shall weigh 1.377 pounds per lineal foot.
d. Steel muntin profiles must be a minimum of 1-3/4″ in depth.
3. Glazing beads shall be extruded aluminum Alloy 6063-T5 with a minimum thickness of 0.045 inches.
4. Hardware reinforcements shall be 7, 10 or 12 gauge steel to suit specified hardware.
5. All screws that are furnished by Hope’s for hardware, trim, covers, anchoring, weather bars, water dams, screens, etc. shall be non-ferrous brass or stainless steel. Glazing bead screws are plated steel.
6. Finishing to include manufacturer's standard five-step process including:

a. Cleaning.
b. Pretreatment with Hot-Dip Galvanizing.
c. Brush-Off Blast Cleaning.
d. Epoxy Powder Primer.
e. Polyester Powder Top Coat or Ultrathane polyurethane Top Coat

B. Fabrication:
1. Fabricate steel doors in accordance with approved shop drawings.
2. Corners of frame and ventilator shall be mitered or coped then solidly welded. Exposed and contact surfaces shall be finished smooth flush with the adjacent surfaces. All interior and exterior rail bar and muntin joints shall be solidly welded.
3. Kickpanels, lockboxes and lockstiles shall be composite profiles as shown on the shop drawings and glazed into the door leaf.
4. Muntins: True Divided Lite muntins shall be coped and welded to the perimeter frame. Muntin intersections shall be slotted, cross notched and welded. All interior and exterior muntin joints shall be face welded and ground smooth.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Door Frames, Fire-Rated: Fully welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 18 gage, 0.042 inch, minimum.
3. Frame Finish: Factory primed and field finished.

C. Frame width to extend past face of wall or partition on either sides, unless noted or detailed otherwise.

D. Hollow Metal Frame Finishes:
1. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.05 ACCESSORIES

A. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

B. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames with bituminous coating to a thickness of 1/16 inch.

3.03 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install fire-rated door as specified in Section 08 1433 - Stile-and-Rail Wood Doors.

E. Install door hardware as specified in Section 08 7100 - Door Hardware.

F. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 08 1423
METAL-CLAD WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-clad wood doors, complete with integral frames, glazing, weatherstripping, fasteners and assessories.

B. Aluminum-clad wood transom panels.

C. Aluminum-clad wood sidelight panels.

1.02 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing: Insulating glass units.

E. Section 09 9123 - Interior Painting: Field finishing of doors.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

G. ASTM E547 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Cyclic Static Air Pressure Differential; 2000 (Reapproved 2009).

H. ASTM E2112 - Standard Practice for Installation of Exterior Windows, Doors and Skylights; 2007.

1.04 PERFORMANCE REQUIREMENTS

A. Doors shall be Hallmark certified to a rating of HGD – LC–PG specifications in accordance with ANSI/AAMA/WDMA 101/I.S.2/A440-08 or ANSI/AAMA/WDMA 101/I.S.2/A440-11.

B. Door Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.15 cfm per square foot of frame or less.

C. Door Unit Water Penetration: No water penetration through door unit when tested in accordance with ASTM E 547, under static pressure of [3.75 psf (40 mph)] [4.5 psf (42 mph)] [6.0 psf (48 mph] [8.36 psf (57 mph] [10.66 psf (64 mph] [0 psf (0 mph)] after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Conference: Conduct a preinstallation meeting at the Project Site prior to the start of the work of this section; require attendance by each affected installer.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review, discuss, and coordinate the interrelationship of wood doors with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and secure exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data, including installation instructions.
1. Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
1. Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples for Initial Selection: For units with factory-applied finishes.
1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
2. Exposed Hardware: Full-size units.

E. Product Schedule: For doors. Use same designations indicated on Drawings.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Warranty Documentation: Submit manufacturer's standard warranty with Project Closeout documents, and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum 15 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prime and seal wood surfaces, including areas to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.

B. Package, deliver and store doors in accordance with specified quality standard.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.

D. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.09 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood door that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, and air infiltration.
c. Faulty operation of movable leaf and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.
2. Warranty Period:

a. Door: 10 years from date of Substantial Completion.
b. Glazing Units, Non-laminated: 20 years from date of Substantial Completion.
c. Glazing Units, Laminated: 10 years from date of Substantial Completion.
d. Aluminum-Cladding Finish: 20 years from date of Substantial Completion

PART 2 PRODUCTS

2.01 ALUMINUM-CLAD WOOD FRENCH HINGED DOORS

A. Basis-of-Design: Subject to compliance with requirements, provide Pella Corporation "Pella Reserve" aluminum-clad wood doors, sidelights and transoms, or comparable product by one of the following:
   1. Marvin Windows, Inc.: www.marvin.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Frame:
   1. Select woods to be water-repellent and preservative-treated in accordance with WDMA I.S.-4.
   2. Interior Exposed Surfaces: Clear pine, edge-banded and veneered. Any curved member may have visible finger-jointed surfaces.
   3. Exterior Surfaces: Clad with aluminum at head and jambs.
   4. Sill: Solid extruded aluminum sill.
      a. 1/2-inch low-profile extruded aluminum with bronze anodized finish.
   5. Overall Frame Depth: 5-7/8 inches (149 mm).

C. Door Panel:
   1. Select woods to be water-repellent and preservative-treated in accordance with WDMA I.S.-4.
   2. Panel Rails and Stiles: Three-ply construction. Randomly finger-jointed blocks laminated with water-resistant glue and veneered both sides.
   3. Interior Exposed Surfaces: Veneered Clear Pine.
   4. Exterior Surfaces: Clad with extruded aluminum butt-jointed at all corners of the panel with through-stile construction.
   5. Panel Profile: Exterior profile is ogee, interior profile is ogee.
   6. Corners: Urethane-sealed and secured with metal fasteners and structural adhesive.
   7. Panel Face to Glass Reveal: 0.63 inches (16 mm).
   8. Panel Thickness: 2-1/16 inches (52 mm)

D. Weather Strip: Dual-durometer extruded polymer along perimeter of door frames and along the bottom of door panels.

E. Insulating Glass Units: See Section 08 8000 Glazing.

F. Simulated Divided Lights: Provide divider grilles (false muntins) in designs indicated for each light.
   1. Pattern: As shown on Drawings.
   2. Room Side Grilles: 7/8" wide ogee profile that are solid Clear Pine.
   3. Exterior Grilles: Extruded aluminum 7/8" ogee. Dimension to match room side grilles.
   4. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with non-glare grid.
   5. Grille edge to glass Reveal: 0.63 inches (16 mm) to reflect historic window proportions.
   6. Finish: Finishes to match interior and exterior finishes.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with AAMA/WDMA/CSA 101/I.S.2/A440 requirements in accordance with the following:
   1. Performance Class (PC): LC.
   2. Performance Grade (PG): 25, with minimum design pressure (DP) of 25.06 psf.

B. Performance Validation: Side hinged doors (SHD) shall comply with AAMA/WDMA/CSA 101/I.S.2/A440 performance requirements as indicated by having AAMA, WDMA, or CSA

certified label, or an independent test report for indicated products itemizing compliance and acceptable by authorities having jurisdiction.

C. Water Penetration Resistance: No uncontrolled leakage on interior face when tested in accordance with ASTM E547 at differential pressure of 15 percent of Performance Grade (PG).

D. Air Leakage: Maximum of 0.30 cu ft/minute/sq ft at 1.57 psf differential pressure, when tested in accordance with ASTM E283.

E. Thermal Transmittance: U-factor of 0.35, maximum, that includes window glazing, door and frame system based on average window size required for project and determined in accordance with NFRC 100.

F. Acoustical Performance: Sound Transmission Class (STC) rating of 27, Outdoor/Indoor Transmission Class (OITC) rating of 24, when tested in accordance with ASTM E90.

2.03 FABRICATION

A. Fabricate doors in accordance with door quality standard specified.

B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

D. Cut and configure exterior door edge to receive recessed weatherstripping devices.

E. Provide edge clearances in accordance with the quality standard specified.

F. Tolerances: Doors shall accommodate the following opening tolerances:
   1. Vertical Dimensions Between High and Low Points: Plus 1/8 inch, minus 0 inch.
   2. Width Dimensions: Plus 1/8 inch, minus 0 inch.
   3. Building Columns or Masonry Openings: Plus or minus 1/8 inch from plumb.

2.04 FACTORY FINISHING - WOOD VENEER INTERIOR FACE

A. Finish work in accordance with WDMA I.S. 1A for Grade specified and as follows:
   1. Transparent:
      a. System - TR-2, Catalyzed Lacquer.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

2.05 EXTERIOR FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

A. Comply with requirements in section 08 7100 Door Hardware.

2.07 ACCESSORIES

A. Installation Accessories: As recommended by manufacturer for installation method.

B. Door Astragals: Thickness, wood species, and interior and exterior finishes to match door; provide with weatherseals.

C. Flashing/Sealant Tape: UV resistant, aluminum-foil-backed, butyl window and door flashing tape.
   1. Verify sealant compatibility with sealant manufacturer.

D. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.

E. Exterior Perimeter Sealant: High quality, multi-purpose sealant as specified in Section 07 9200 Joint Sealants.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

E. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions, approved shop drawings, and specified quality standard.

B. Assemble multiple units before installation in accordance with manufacturer's installation guidelines.

C. Install doors to be weather-tight and freely operating.

D. Maintain alignment with adjacent work.

E. Secure assembly to framed openings, plumb and square, without distortion.

F. Integrate door system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with door manufacturer's instructions.

G. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

H. Use machine tools to cut or drill for hardware.

I. Coordinate installation of doors with installation of integral frames and hardware.

J. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant.

K. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 CLEANING

A. Remove protective material, labels and visible marki from factory finished surfaces.

B. Clean units using cleaning material and methods in accordance with door manufacturer's written recommendations. Do not use harsh cleaning materials or methods that would damage finish.

3.06 PROTECTION

A. Protect installed work from damage due to subsequent construction activity on the site, and ensure doors will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 08 1433
STILE AND RAIL WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood doors, stile and rail design; fire rated and non-fire rated.

B. Panels of wood and glass.

C. Wood screen doors, stile and rail design; non-fire-rated.

1.02 RELATED REQUIREMENTS

A. Section 06 2000 - Finish Carpentry: Wood door frames.

B. Section 08 1313 - Hollow Metal Frames.

C. Section 08 7100 - Door Hardware.

D. Section 08 8000 - Glazing.

E. Section 09 9123 - Interior Painting: Field finishing.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

D. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate stile and rail core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required , special beveling , special blocking for hardware , factory machining criteria , factory finishing criteria , identify cutouts for glazing.

D. Samples:
   1. Door veneer finish: Submit two samples, minimum 6-inch x 6- inch in size, illustrating factory wood finish.
   2. Screen door mesh: Submit two samples, minimum 6-inch x 6-inch in size.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Manufacturer's Installation Instructions: Indicate special installation instructions.

G. Manufacturer's Qualification Statement.

H. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver, and store doors in accordance with quality standard specified.

B. Protect doors with resilient packaging sealed with heat shrunk plastic. Break seal on site to permit ventilation. Do not store in damp or wet areas. Seal top and bottom edges with tinted sealer if stored more than one week.

1.07 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
   1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Stile and Rail Wood Doors:
   1. Eggers Industries; ____: www.eggersindustries.com/#sle.
   2. Maiman Company; ____: www.maiman.com/#sle.
   3. Marshfield DoorSystems, Inc; _____: www.marshfielddoors.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Stile and Rail Wood Screen Doors:
   1. The Combination Door Company: www.combinationdoor.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Quality Standard: Premium Grade, Standard Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Opaque finish as indicated on drawings.

C. Screen Doors: 1-1/16 inches thick unless otherwise indicated; solid lumber construction; mortise and tenon joints. Opaque finish as indicated on drawings.

D. Design Style/Pattern: As shown on Drawings..

2.03 DOOR AND PANEL FACINGS

A. Materials for Opaque Finishes: Hardboard faces.

B. Adhesive: Type I - Waterproof.

2.04 COMPONENTS

A. Glazing: As specified in Section 08 8000.

B. Panel or Glass Retention Molding: Wood of same species as door facing, molded stop applied one-side,mitered corners; prepared for countersink style tamper proof screws.

C. Door Hardware: As specified in Section 08 7100.

D. Screen Door Mesh: Manufacturer's standard, removable, aluminum mesh screen.
   1. Color: Bronze.

2.05 DOOR CONSTRUCTION

A. Astragals for Double Doors: Wood, ____ shaped, overlapping and recessed at face edge, specifically for double doors.

B. Vertical Exposed Edge of Stiles: Of same species as veneer facing.

C. Fit door edge trim to edge of stiles after applying veneer facing.

D. Bond edge banding to cores.

E. Panels: Flat.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware.

G. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

H. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

I. Factory install glazing in doors in compliance with quality standards specified, using manufacturer's standard elastomeric glazing sealant.

J. Factory install screen door mesh in compliance with quality standards specified and approved shop drawings.

K. Fire Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

L. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252 or UL 10B - Negative (Neutral) Pressure; listed in UL (DIR) or ITS (DIR) and without any visible seals when door is open.

2.06 FACTORY FINISHING

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Opaque:
      a. System - 10, UV Curable, Water-based.
      b. Color: As selected by Architect.
      c. Sheen: Flat.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Wood Door Frames: As specified in Section 06 2000.

B. Hollow Metal Door Frames: As specified in Section 08 1313.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standards.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Field-Finished Doors: Trimming to fit is acceptable.
   1. Adjust width of non-rated doors by cutting equally on both jamb edges.
   2. Trim door height by cutting bottom edges to a maximum of 3/4 inch.

D. Machine cut for hardware.

E. Coordinate installation of doors with installation of frames and hardware.

F. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit, clearance, and joinery tolerances.

B. Maximum Width Distortion (Cup): 1/8 inch measured with straight edge or taut string, edge to edge, over an imaginary 36 by 84 inch surface area.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 08 1473
SLIDING WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior sliding wood door systems.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.

B. Section 09 9123 - Interior Painting: Opaque finishes.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, and installation requirements.

D. Manufacturer's Instructions: Indicate installation.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Executed warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified in this section, with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site and store in manufacturer's protective cartons until openings ready for door installation.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting and misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Sliding Wood Door Systems:
   1. Andersen Windows, Inc; ____: www.andersenwindows.com/#sle.
   2. Pella Corporation; ____: www.pellacommercial.com/#sle.
   3. Marvin Windows and Doors, Inc.; www.marvin.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 INTERIOR SLIDING WOOD DOOR SYSTEMS

A. Sliding Wood Doors: Solid wood door and operable panel frame, factory-glazed and factory-fabricated, with flashings, anchorage devices, and integral sloped threshold.
   1. Panel Configuration: As indicated on drawings.
   2. Door Type: Flush wood door with particleboard core.
   3. Veneer Facing for Opaque Finish: Manufacturer's standard.
   4. Door Finish: Factory primed for field finishing.
   5. Door Thickness: 1-3/4 inches.
   6. Wall Thickness: 4-7/8 inches.
   7. Operable Panels: Adjustable, with stainless steel bottom rollers.
   8. Threshold: Extruded aluminum, finished to match frame.

B. Track Systems for Top-Hung Doors: Adjustable aluminum track with or without trim wrapping head of opening and wall at jambs; includes concealed receiving channel, factory-installed locks, and brush seals.
   1. Configuration: Flush-mount within wall.
   2. Carriage Assembly: Weight rating of 220 lb, minimum.
   3. Operation: Manual.
   4. Gaskets: Full gasketing, integral, double seal.
   5. Finish: Class II natural anodized.
   6. Products:
      a. KLEIN Architectural Systems; SLID: www.klein.pro/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.03 COMPONENTS

A. Hardware:
   1. Ladder Pull: 12 inches long, with passage latch.
   2. Lock: Door system manufacturer's standard cylindrical lock.
   3. Single Action Latch Release: With privacy lever latch retraction via cylindrical lever.
   4. Material: Anodized aluminum.
      a. Color: As selected by Architect from manufacturer's standard range.

2.04 ASSEMBLY

A. Factory assemble frame as one unit, including head jambs and sill. Factory assemble operating panels, fixed panels, and sidelites.

B. Sizes: Allow for tolerances of rough framed openings, clearances, and shims around perimeter of assemblies.

C. Joints and Connections: Flush, hairline width, and waterproof, with rigidly joined corners.

2.05 FINISHES

A. Aluminum Finish:
   1. Class I Natural Anodized: AAMA 611 AA-M12C22A41, clear anodic coating minimum 0.7 mil, 0.0007 inch thick.
   2. Class II Natural Anodized: AAMA 611 AA-M12C22A31, clear anodic coating minimum 0.4 mil, 0.0004 inch thick.

B. Wood Finish: See Section 09 9123.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 ACCESSORIES

A. Sliding Panel Bottom Rollers: Stainless steel, adjustable from interior.

B. Limit Stops: Resilient rubber.

C. Anchors: Hot-dip galvanized steel.

D. Blocking: Provide support wall blocking as required for sliding door locations in accordance with sliding door manufacturer's requirements.

E. Sealant: As recommended by door system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings ready to receive work. Verify opening dimensions and clearances as indicated on drawings.

3.02 PREPARATION

A. Prepare opening to permit indicated installation of door unit.

3.03 INSTALLATION

A. Install sliding door units in accordance with manufacturer's instructions.

B. Attach frame and shims to perimeter opening, accommodating construction tolerances and other irregularities.

C. Use anchorage devices to securely fasten sliding door assembly to wall construction without distortion or imposed stresses.

D. Place threshold in bed of sealant.

E. Install operating hardware in accordance with manufacturer's instructions.

F. Install perimeter trim and interior closures.

G. Field Finishing: Finish wood doors with opaque materials; see Section 09 9123.

3.04 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation from Plumb: 1/16 inch.

C. Maximum Variation from Level: 1/16 inch.

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 foot straight edge.

3.05 ADJUSTING

A. Adjust hardware for smooth operation.

3.06 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Remove protective material from factory-finished surfaces.

C. Remove labels and visible markings.

D. Wash surfaces by method acceptable to sealant and sliding door manufacturer. Rinse and wipe surfaces clean.

E. Upon completion of installation, clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Wall mounted access units.

B. Ceiling mounted access units.

1.02 RELATED REQUIREMENTS

A. See Fire Protection, Plumbing, Mechanical, Electrical, and other associated trades for components located above hard lid ceilings and within walls that may require access panels to reach them. Locations may not be visually shown on drawings but where device is installed and concealed an access panels must be provided. It is encouraged to locate device, valve, etc. in location accessible to avoid installation of access panel. GC responsible to coordinate panel locations among trades to reduce quantity and verify acceptiblity with Architect.

1.03 REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. UL (FRD) - Fire Resistance Directory; current edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Manufacturer's Installation Instructions: Indicate installation requirements.

E. Manufacturer's Qualification Statement.

F. Project Record Documents: Record actual locations of each access unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:
   1. Panel Material: Aluminum extrusions with gypsum board inlay.
   2. Size: 12 inch by 12 inch, minimum or as required to permit access. Coordinate size with other trades access panel is used for.
   3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   4. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Fire-Rated Wall-Mounted Units:
   1. Wall Fire-Rating: As indicated on drawings.
   2. Panel Material: Steel.
   3. Size: 12 inch by 12 inch., minimum or as required to permit access. Coordinate size with other trades access panel is used for.
   4. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

C. Ceiling-Mounted Units with Return Air Grille:

1. Panel Material: Aluminum extrusion with gypsum board inlay.
2. Size: 12 inch by 12 inch., minimum or as required to permit access. Coordinate size with other trades access panel is used for.
3. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

D. Fire-Rated Ceiling-Mounted Units:
1. Ceiling Fire-Rating: As indicated on drawings.
2. Panel Material: Steel.
3. Size: 12 inch by 12 inch., minimum, or as required to permit access. Coordinate size with other trades access panel is used for.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL AND CEILING MOUNTED ACCESS UNITS

A. Manufacturers:
1. BASIS OF DESIGN: ACUDOR Products Inc: www.acudor.com/#sle.
a. DW-5040 Acudor Flush Drywall Access Door
2. Cendrex, Inc: www.cendrex.com/#sle.
3. J.L. Industries Inc: www.activarcpg.com/jl-industries
4. Milcor, Inc: www.milcorinc.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Door Style: Single thickness with rolled or turned in edges.
2. Flange: 1-9/32 flange, Integral perforated taping bead add extra rigidity
3. Frames: 16 gage, 0.0598 inch, minimum thickness.
4. Door Panels to Receive Wall/Ceiling Finish: Surface recessed 5/8 inch back from wall face.
5. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
a. Provide products listed by ITS (DIR) or UL (FRD) as suitable for purpose indicated.
b. Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated doors.
6. Steel Finish: Primed.
7. Aluminum Finish: Natural brushed.
8. Primed and Factory Finish: Polyester powder coat; color manufacturer's standard.
9. Hardware:
a. Hardware for Fire-Rated Units: As required for listing.
b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

2.03 WALL MOUNTED ACCESS UNITS WITH RETURN AIR GRILLES

A. Gypsum Board Inlay Access Panels: Provide rectangular and square access panel with recessed and gasketed aluminum perimeter frame that acts as finishing edge and having concealed mechanical touch-latch with safety cable and free-pivoting hinge.
1. Rectangular Panel Frame Size: 24 by 36 inches set within 1/2 inch thick gypsum board.
2. Square Panel Frame Size: 24 by 24 inches set within 1/2 inch thick gypsum board.
3. Panel Frame: 1 inch margin with concealed countersunk screw mounting.

B. Air Return Grille: Custome grille by Pacific Register. Style: Celtic Cross.
1. Grille: Fixed grilles with 1/4 inch thick by 5/8 inch deep bars at 1/2 inch on center providing 48 percent free space opening.
2. Grille Size: 12 by 12 inches set within 1/2 inch thick gypsum board.
3. Fabrication: Aluminum with factory powder coated finish.
4. Grille Frame: 1 inch margin with concealed countersunk screw mounting.

2.04 EXTERIOR APPLICATION

A. Provide matching wood tongue and groove access panel where applicable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.03 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Drawings do not show all access panels and Contractor is responsible to provide all access panels as required for a complete installation.

C. Coordinate installation locations with other trades (Mechanical, Electrical, etc.) to ensure proper size is provided to allow access to items beyond access panel. Adjust size as necessary to accomodate access. Locate and install additional access panels as needed.

D. Locate devices that require access above lay-in acoustical ceilings when possible. Provide access panel where necessary when behind gypsum board walls / ceilings.

E. Install frames plumb and level in openings, and secure units rigidly in place.

F. Position units to provide convenient access to concealed equipment when necessary.

G. Field paint access panels where necessary to match adjacent finishes.

END OF SECTION

SECTION 08 3613
SECTIONAL DOORS - CLOPAY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Steel sectional doors.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM A924/A924M - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process; 2026.

C. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

D. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

E. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

F. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

G. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Show hardware, performance, and physical characterictics.

C. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

D. Manufacturer's Instructions: Include special procedures required by project conditions.

E. Manufacturer's qualification statement.

F. Operation and Maintenance Data: Include normal operation, troubleshooting, and adjusting.

G. Executed warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 5 years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 5 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store doors in accordance with manufacturer's instructions.

1.06 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for warranty requirements.

B. Manufacturer Warranty: Provide 1-year manufacturer warranty for electric operating equipment. Complete forms in Owner's name and register with manufacturer.

C. Special Warranty: Provide 5-year warranty for delamination commencing on Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Clopay Corporation: www.clopaydoor.com/#sle.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Pressure: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10-second duration of maximum load.

B. Air Leakage Rate: Maximum 0.40 cfm/sq ft when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf.

C. Thermal Transmittance: 0.31 Btu/hr sq ft degrees F, maximum, in accordance with DASMA 102.

2.03 STEEL SECTIONAL DOORS

A. Basis-of-Design: Clopay Corporation; Coachman residential garage door.
   1. Door Design: Series 2 Design 21
   2. Window Design: REC 13, clear glass
   3. Model: CG, 2" insulated
   4. Color: As selected from manufacturer's standard range.
   5. Hardware: Decorate hinges, plates and handles as selected from manufacturer's standard range.

B. Light-Ribbed, Raised Panel, and Flush Steel Doors, Thermally Broken, Polystyrene Insulated.
   1. Door Construction: Sandwich construction of exterior and interior steel skins pressure-bonded to expanded core, with skins separated by continuous, silicone, thermal break filling.
   2. Panel Thickness: 2 inches.
   3. Skin Thickness: 27-gauge, 0.016-inch, exterior minimum; 27-gauge, 0.016-inch interior minimum.
   4. Astragal: U-shaped flexible PVC.
   5. Thermal Characteristics:
      a. R-Value: 9.0.
   6. Finish: Factory-standard coating.
      a. Color: As selected by Architect from manufacturer's standard line.
   7. Windows: _____, clear float glazing; dual pane; 1/8-inch thick.
   8. Locking: No lock.
   9. Operation: Electric control station.

2.04 COMPONENTS

A. Door Stiles: Galvanized, turn-down steel ends, 1-3/8 inches panel section wrap.

B. Track: Galvanized steel, 2 inches wide, one continuous piece per side; galvanized steel mounting brackets, long-stem tandem rollers, standard lift.

C. Spring Counterbalance: Torsion-spring mechanism mounted on steel shaft with center coupling. Die-cast aluminum cable drum with galvanized cable.
   1. Cable Safety Device: Snubbers to maintain cable tension.
   2. Spring Cycles: 10,000 cycles.

D. Weatherstripping: Perimeter seal fitted to top, bottom, and jambs of door.

E. Manual Operation Safety: ControlGard SD direct-drive chain hoist with intergral brake, 2.8:1 primary reduction in 1-inch bore.

F. Door-Drop Safety Device: Brackets designed to stop fall of door during cable failure.

2.05 MATERIALS

A. Sheet Steel: Roll-formed galvanized in accordance with ASTM A653/A653M and ASTM A924/A924M, G60 coating.

B. Aluminum Extrusions: ASTM B211/B211M, 6063 alloy, T6 temper.

2.06 ELECTRIC MOTOR OPERATION

A. Electric Operators:
   1. Manufacturers:
      a. LiftMaster, the Chamberlain Group LLC: Premium Series 6690L.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Description: Slow-start, slow-stop DC motor with overload protection and emergency disconnect for manual operation. Comply with UL (DIR).
      a. Drive Reduction: 65:1 gearbox with No.48 chain output. Provide quick-disconnect door arm for manual operation.
      b. Brake: Standard dynamic braking capable of stopping and holding position of doors.
      c. Electronic Limits: Fully adjustable, stored in master board.
      d. Motor: 78 percent high efficiency, 5,000 rpm, 120 V, 1-phase.
      e. Speed: 8 to 12 inches per second.
      f. Gearbox: Aluminum, integrated mechanical structure, custom worm design with seals.
      g. Wall Controller: 2-wire floor-level controller, Wi-Fi, remote, and myQ connectivity, cycle counter. Housing in accordance with NEMA 1or NEMA 4X.
         1) Provide manufacturer's standard wall controller, keypad and two (2) remotes.
      h. Battery Backup: Equipped with two 12 V batteries for minimum of 20 cycles. Optional battery kit DC7AH includes battery enclosure and two 7 Ah batteries.
      i. Inputs: Four programmable inputs for dry-contact accessories including nonmonitored devices, car-dealer input, timer defeat, all fly, truck presence sensors, and dock sensors. Terminals for three monitored safety entrapment protection devices.
      j. MyQ Technology: 900 MHz and Wi-Fi; Liftmaster Internet Gateway; monitored and operated with smartphone, tablet, or computer.
      k. Duty Cycle: 20 cycles per hour, 90 cycles per day for standard models (S), 30 cycles per hour, 150 cycles per day for extended-duty models (X).
      l. Primary Entrapment Protection Devices: Monitored photo eyes, noncontact, photo-beam-reversing photo sensor system.

B. See Division 26 for electrical connections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify wall openings are prepped for work, and opening dimensions and tolerances meet limits specified on shop drawings.

B. Before proceeding with work, notify Architect if substrate conditions do not meet manufacturer's standards.

C. Verify availability and operation of electric power.

3.02 PREPARATION

A. Prepare opening for door unit installation to perimeter air and vapor barrier seal.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Secure door tracks suspended from structure to structural members only.

D. Fit and align door assembly including hardware.

E. Maintain dimensional tolerances and alignment with adjacent work.

F. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 feet straight edge.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Manufacturer Services: Provide services of manufacturer's field representative to observe operation and identify adjustments to door assembly for specified operation.

3.06 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.07 CLEANING

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements.

B. Clean doors, glazing, and frames.

C. Remove temporary labels and visible markings.

3.08 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

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

END OF SECTION

SECTION 08 5213
METAL-CLAD WOOD WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-clad wood double-hung windows, complete with hardware, insulated glazing units, weatherstripping, extruded aluminum brick mold trim, simulated divided lights with putty bevels and spacer bars, fasteners and accessories.

1.02 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements

B. Section 01 7000 - Execution and Closeout Requirements

C. Section 06 2000 - Finish Carpentry; for wood trim other than furnished by window manufacturer.

D. Section 07 9200 - Joint Sealants: Sill sealant and perimeter caulking

E. Section 08 8000 - Glazing: Insulating glass units.

F. Section 09 9123 - Interior Painting; for painting areas other than factory-applied finish.

1.03 REFERENCES

A. American Society for Testing Materials (ASTM):
   1. E283: Standard Test method for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors
   2. E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Door by Uniform Static Air Pressure Difference
   3. E547: Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential
   4. E2190: Specification for Sealed Insulated Glass Units
   5. C1036: Standard Specification for Flat Glass
   6. F 2090-17: Standard Specifications for Windows Fall Prevention Devices with Emergency Escape (egress) Release Mechanisms

B. American Architectural Manufacturer's Association/Window and Door Manufacturer's Association (AAMA/WDMA/CSA):
   1. AAMA/WDMA/CSA 101/I.S.2/A440-08, Standard/Specification for windows, doors and skylights
   2. AAMA/WDMA/CSA 101/I.S.2/A440-11, Standard/Specification for windows, doors and skylights
   3. AAMA 450-10, Voluntary Performance Rating Method for Mulled Fenestration Assemblies

C. WDMA I.S.4: Industry Standard for Water Repellant Preservative Treatment for Millwork

D. Window and Door Manufacturer's Association (WDMA): 101/I.S.2 WDMA Hallmark Certification Program

E. Sealed Insulating Glass Manufacturer's Association/Insulating Glass Certification Council (SIGMA/IGCC)

F. American Architectural Manufacturer's Association (AAMA): 2605: Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels

G. National Fenestration Rating Council (NFRC):
   1. 101: Procedure for Determining Fenestration Product thermal Properties
   2. 200: Procedure for Determining Solar Heat Gain Coefficients at Normal Incidence

H. Window Covering Manufacturer's Association
   1. A100.1: American National Standard for Safety of Corded Window Coverings Products

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review, discuss, and coordinate the interrelationship of wood windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
   3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
   4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.05 SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.

B. Shop Drawings: For windows.
   1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation

C. Product Schedule: For windows. Use same designations indicated on Drawings.

D. Samples for Initial Selection: For units with factory-applied finishes.
   1. Exposed Finishes: 2 by 4 inches (50 by 100 mm).
   2. Exposed Hardware: Full-size units.

E. Samples for Verification: For windows and components required, prepared on samples of size indicated below
   1. Submit corner section of window. Include glazing system, quality of construction and specified finish.

F. Quality Control Submittals: Certificates or product test reports.
   1. Submit manufacturer’s certification indicating compliance with specified performance and design requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Products must be certified by independent third parties and labeled as having been produced in compliance with the accepted principles of sustainable forest management. Current sustainability certification systems that comply include the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), and Program for the Endorsement of Forest Certification (PEFC).

B. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup of typical window installation as indicated on Drawings.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE AND HANDLING

A. Prime and seal wood surfaces, including areas to be concealed by wall construction, if more than thirty (30) days will expire between delivery and installation.

B. Deliver in original packaging and protect from weather.

C. Store window units in an upright position in a clean and dry storage area above ground to protect from weather.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection, water leakage, and air infiltration.
      c. Faulty operation of movable sash and hardware.
      d. Deterioration of materials and finishes beyond normal weathering.
      e. Failure of insulating glass.
   2. Warranty Period:
      a. Window: 10 years from date of Substantial Completion.
      b. Glazing Units, Non-laminated: 20 years from date of Substantial Completion.
      c. Glazing Units, Laminated: 10 years from date of Substantial Completion.
      d. Aluminum-Cladding Finish: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SOURCE LIMITATIONS

A. Obtain windows from single source from single manufacturer.

2.02 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
   1. Window Certification: WDMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: LC.
   2. Minimum Performance Grade: 25.

C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.35 Btu/sq. ft. x h x deg F (2.0 W/sq. m x K).

D. Sound Transmission Class (STC): Rated for not less than 26 STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.

E. Outside-Inside Transmission Class (OITC): Rated for not less than 22 OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

2.03 ALUMINUM-CLAD WOOD WINDOWS

A. Basis-of-Design: Subject to compliance with requirements, provide Pella Corporation; Pella Reserve windows or comparable product by one of the following:
   1. Marvin Windows, Inc.: www.marvin.com.
   2. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Double hung.
   2. Fixed.

C. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints on linear members, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch (0.8 mm) dep by 2 inches (51 mm) wide; water-repellent preservative treated.
   1. Exterior Finish: Aluminum-clad wood.
      a. Color: To be selected by Architect from Manufacturer's full range.

2. Interior Finish: Manufacturer's standard factory-prime coat.

D. Insulating-Glass Units: See Section 08 8000 - Glazing.

E. Simulated Divided Lights: Provide divider grilles (false muntins) in designs indicated for each sash light.
   1. Muntins adhere to glass with closed-cell copolymer acrylic foam tape with spacer bar.
   2. Pattern: As shown on Drawings.
   3. Exterior sticking: Putty bevel.
      a. Finish: Exterior to match aluminum clad window finish.
   4. Interior sticking: Standard ogee muntin.
      a. Finish: Interior to match interior wood species and window finish.

F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: To be selected by Architect from manufacturer's full range.

G. Hung Window Hardware:
   1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
   2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Provide custodial locks.
   3. Tilt Hardware: Releasing tilt latch allows sash to pivot about horizontal axis to facilitate cleaning exterior surfaces from the interior.
   4. Sash Opening Limit Device: Manufacturer's standard concealed support device to restrict sash opening.

H. Weatherstripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

I. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
   1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.04 ACCESSORIES AND TRIM

A. Installation Accessories: As recommended by manufacturer for installation method.
   1. Factory-installed vinyl nailing/drip cap.
   2. Installation brackets: 6 3/8” (162mm), 9 3/8” (283mm), 15 3/8” (390mm).
   3. Masonry brackets: 6” (152mm), 10” (254mm).

B. Insect Screens:
   1. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.
      a. Type and Location: Full, outside for double-hung sashes.
      b. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
      c. Finish for Exterior Screens: Matching color and finish of aluminum cladding.
      d. Glass-Fiber Mesh Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M and SMA 1201.
         1) Mesh Color: Manufacturer's standard.

2.05 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weatherstrip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction

C. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action (dissimilar materials, treated lumber, etc.) at the points of contact with other materials.

D. For fin method of attachment, integrate window system installation with exterior water-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with water-resistant barrier using watershed principles in accordance with window manufacturer's written instructions.

E. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using backer rod and sealant.

F. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
   1. Install sealant and related backing materials at perimeter of unit or assembly in accordance with Section 07 9200 Joint Sealants.

G. Install accessory items as required.

H. Install wood trim and moldings as specified. Comply with requirements in Section 06 2000 Finish Carpentry.
   1. Use finish nails to apply wood trim and mouldings.

I. Field Finishing: Coat interior surfaces with specified paint. Comply with requirements in Section 09 9123 Interior Painting.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner may, at their own expense, engage a qualified independent testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of installed windows to take place as follows:

1. Air-Infiltration Testing:
    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.
2. Water-Resistance Testing:
    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration
3. Testing Extent: Minimum three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows to be tested after perimeter sealants have completely cured.
4. Test Reports: Prepared in accordance with AAMA 502.
5. Interpretation of Results: Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
6. Windows will be considered defective if they do not pass tests and inspections.
    a. Contractor to correct deficiencies or replace defective window at their own expense.

3.04 ADJUSTING, CLEANING AND PROTECTION

A. Remove visible labels and adhesive residue according to manufacturer’s instruction.

B. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

C. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
    1. Keep protective films and coverings in place until final cleaning.

D. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

E. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions

F. At Substantial Completion, remove protective films and perform final cleaning. Leave windows and glass in a clean condition.

END OF SECTION

SECTION 08 7100
DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Gates.
   4. Other doors to the extent indicated.

B. Additional hardware specified in other Sections:
   1. Section 08 1473 - Sliding Wood Doors; track hardware.
   2. Section 08 3613 - Sectional Doors; overhead door hardware.
   3. Section 13 3413.13 - Greenhouses; for greenhouse door hardware.
   4. Section 13 3423 - Fabricated Structures; for garden shed door hardware.

C. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Cylinders specified for doors in other Sections.

D. Thresholds.

E. Weatherstripping, seals and door gaskets.

1.02 RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Frames.

B. Section 08 1423 - Metal-Clad Wood Doors.

C. Section 08 1433 - Stile and Rail Wood Doors.

D. Section 08 1473 - Sliding Wood Doors.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

D. BHMA A156.3 - American National Standard for Exit Devices; 2014.

E. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

F. BHMA A156.5 - American National Standard for Cylinders and Input Devices for Locks; 2014.

G. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.

H. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

I. BHMA A156.21 - American National Standard for Thresholds; 2014.

J. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

N. NFPA 101 - Life Safety Code; 2015.

O. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

P. State Building Codes, Local Amendments.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

C. Convey Owner's keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

C. Door Hardware Schedule: Prepared by or under the supervision of supplier, provide detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents.
   1. 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.
   2. Submittal Sequence: Submit door hardware schedule at earliest possible date; schedule must precede fabrication of other work. Include product data, samples, shop drawings of other work affected by door hardware, and othe rinformation essential to the coordinated review of the door hardware schedule.

D. Keying Schedule: Submit for approval of Owner.
   1. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions.
   2. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/ cores.

E. Samples: Provide the following prior to preparation of hardware schedule;
   1. Submit one (1) full-size sample of each type of hardware specified illustrating selected style, color, and finish.
   2. Samples will be incorporated into the Work.

F. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and ____.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware approved by manufacturer.

D. Source Limitations: Obtain each type and variety of door hardware specified in this Section from a single source unless otherwise indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door and hardware schedule.

1.08 COORDINATION:

A. Keying Conference: Conduct conference with Owner as required to confirm key system requirements, delivery of keys, and installation of permanent cylinder cores.

B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory-prepared for installing hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

1.09 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Manufacturer's Warranty: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of hardware that fail 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.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 DOOR HARDWARE - GENERAL

A. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:
   1. Applicable provisions of federal, state, and local codes.
   2. Fire-Rated Doors: NFPA 80.
   3. Hardware on Fire-Rated Doors, Except Hinges: Listed and classified by UL as suitable for the purpose specified and indicated.
   4. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
   5. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

D. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

E. Finishes: Identified in schedule.

2.02 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.
   1. If no hardware set is indicated for a swinging door provide an office lockset.
   2. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.
   3. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer’s standard tumbler type, six-pin standard core.
   1. Provide cams and/or tailpieces as required for locking devices required.

C. Keying: Keyed in like-groups.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.03 PRIVACY LATCHES

A. Latches: Provide a privacy latch (occupancy indicator) for every door to a public restroom or toilet room, unless specifically indicated.

B. Products:
   1. Rejuvenation, a division of Williams-Sonoma, Inc.; Vacancy Door Lock; aged brass finish.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.04 HINGES

A. Hinges: Provide hinges on every swinging door.
   1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
   2. Provide non-removable pins on exterior outswinging doors.

B. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7; standard weight, unless otherwise indicated.
   1. Provide hinge width required to clear surrounding trim.

C. Quantity of Hinges Per Door:
   1. Doors up to 60 inches High: Two hinges.
   2. Doors From 60 inches High up to 90 inches High: Three hinges.

D. Products:
   1. Rejuvenation, a division of Williams-Sonoma, Inc.; Ball-Tip Door Hinge; burnished antique finish.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.05 LEVERS

A. Products:
   1. Exterior Lever: Rejuvenation, a division of Williams-Sonoma, Inc.; Emry Lever Handle Exterior Door Set with traditional keyed lock; burnished antique finish.
   2. Interior Lever: Rejuvenation, a division of Williams-Sonoma, Inc.; Emry Lever Handle Interior Door Set with or without traditional keyed lock (depending on location, see hardware schedule); burnished antique finish.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.06 PUSH/PULLS

A. Push/Pulls: Comply with BHMA A156.6.
   1. Provide push/pulls on doors not specified to have an exit device.

B. Products:
   1. Rejuvenation, a division of Williams-Sonoma, Inc.; Lachlan Push Plate with Handle; burnished antique finish.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.07 CYLINDRICAL LOCKSETS

A. Locking Functions: As defined in BHMA A156.2, and as follows.

B. Manufacturers - Cylindrical Locksets:
   1. Best Access Systems, division of Stanley Security Solutions; ____: www.bestaccess.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.08 AUXILIARY LOCKS (DEADBOLTS)

A. Locking Functions: As defined in BHMA A156.5, and as follows:

B. Manufacturers - Auxiliary Locks (Deadbolts):

1. DORMA USA, Inc; D800 Series: www.dorma.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.09 EXIT DEVICES

A. Locking Functions: Functions as defined in BHMA A156.3, and as follows:
   1. Entry/Exit, Always-Latched: Key outside locks and unlocks lever, no latch holdback (dogging).

B. Manufacturers - Exit Devices:
   1. Von Duprin, an Allegion brand; 33A/ 35A Series Exit Device; Finish 613 oil-rubbed bronze.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.10 CLOSERS

A. Closers: Complying with BHMA A156.4.
   1. Provide surface-mounted, door-mounted closers unless otherwise indicated.
   2. Provide a door closer on every exterior door where specified.

B. Manufacturers - Surface Mounted Closers:
   1. DORMA USA, Inc; 7400 Series: finish 613E oil-rubbed bronze.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.11 GASKETING AND THRESHOLDS

A. Gaskets: Complying with BHMA A156.22.
   1. On wood doors with fire rating more than 20-minutes, provide frame-applied intumescent gaskets.
   2. On each exterior door, provide weatherstripping gaskets, unless otherwise indicated; top, sides, and meeting stiles of pairs.
   3. On each exterior door, provide door bottom sweep, unless otherwise indicated.
   4. Coordinate with door manufacturer for recommended gasketing.

B. Thresholds: Complying with BHMA A156.21.
   1. At each exterior door, provide a threshold unless otherwise indicated.
   2. Coordinate with door manufacturer for recommended threshold.

C. Fasteners At Exterior Locations: Non-corroding.

D. Manufacturers - Gasketing and Thresholds:
   1. Assa Abloy Brands, McKinney; ____: www.assaabloydss.com.
   2. Pemko Manufacturing Co; ____: www.pemko.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.12 SLIDING DOOR HARDWARE

A. Sliding Door Hardware: See Section 08 1473 - Sliding Wood Doors for pocket door kit. Provide balance of hardware specified below.

B. Pocket Doors: Provide pocket door kit, including header assembly, split studs, hangers, door hanger plates, bumper, guides, floor plate, and end bracket.
   1. By door manufacturer, see Section 08 1473.

C. Pocket Door Pulls:
   1. Rejuvenation, a division of Williams-Sonoma, Inc.; Lachlan Flush Door Pull; aged brass finish.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.13 GATE HARDWARE

A. Hinges:
   1. Assa Abloy Brands; McKinney: www.assaabloydss.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Levers:
   1. Adams Rite; 4568 Series Deadlatch Straight Lever Handle, bronze anodized.

2. Emtek; Helios Passage Door Lever Set, oil-rubbed bronze.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.14 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:
   1. Kickplate: Provide on push side of every door where specified.

B. Manufacturers - Protection Plates and Architectural Trim:
   1. Rockwood Manufacturing Company, an Assa Abloy brand: www.rockwoodmfg.com.
   2. Trimco: www.trimcohardware.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.15 KEY CONTROLS

A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.

B. Facility Manager's Key Cabinet: Sheet steel construction, piano hinged door with key lock.
   1. Mounting: Wall-mounted.
   2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
   3. Size key hooks to hold 6 keys each.
   4. Finish: Baked enamel, manufacturer's standard color.
   5. Key cabinet lock to building keying system.

PART 3 EXECUTION

3.01 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. Verify that doors and frames are ready to receive work; labeled, fire-rated doors and frames are present and properly installed, and dimensions are as indicated on shop drawings.

C. 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.

3.02 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

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

3.03 INSTALLATION

A. Install each item of hardware in accordance with manufacturer's written instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Do not install surface mounted items until finishes applied to substrate are complete.

D. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.

E. 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. DHI TDH-007-20: Installation Guide for Doors and Hardware.
   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.

F. Thresholds: Set exterior door thresholds with full-width bead of elastomeric sealant on each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

G. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

H. 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 existing doors or 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.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Initial Adjustment:
   1. 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.
   2. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   3. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean adjacent surfaces soiled by hardware installation.

B. Clean finished hardware per manufacturer's instructions after final adjustments has been made. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Protect all hardware stored on construction site in a covered and dry place.

C. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

D. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Owner occupancy.

HARDWARE SETS

3.01 HARDWARE SETS - GENERAL

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 submittal process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
   1. Quantities listed are for each pair of doors, or for each single door.
   2. The supplier is responsible for handing and sizing all products.
   3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
   4. Hardware items listed under "existing to remain" are to be cleaned and rehabilitated for proper function.

5. Hardware items listed under "salvage and reinstall" are to be removed from an existing location, cleaned and rehabilitated for proper function, and reinstalled in new location.

3.02 SWING DOORS -- KEY REQUIRED TO LOCK, MAY BE LEFT UNLOCKED

A. HW-1
   1. Doors: 100
   2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	EXIT DEVICE
1 EA	CLOSER
1 SET	WEATHERSTRIPPING

   3. Salvage and reinstall: Salvage existing door and re-hang; reverse swing.
   4. Existing hardware to remain: None.

B. HW-2
   1. Doors: 109A, 109B, 109C
   2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	EXIT DEVICE
1 EA	CLOSER
1 SET	WEATHERSTRIPPING

   3. Salvage and Reinstall: None.
   4. Existing hardware to remain: None.

C. HW-3
   1. Doors: 111
   2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	EXIT DEVICE
1 EA	CLOSER
1 EA	KICKPLATE
1 SET	WEATHERSTRIPPING

   3. Salvage and Reinstall: None.
   4. Existing hardware to remain: None.

D. HW-4
   1. Doors: 116
   2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	INT. LEVER
1 SET	WEATHERSTRIPPING

   3. Salvage and Reinstall: None.
   4. Existing hardware to remain: None.

E. HW-5
   1. Doors: M104A
   2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	INT. LEVER
1 EA	KICKPLATE
1 SET	WEATHERSTRIPPING

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

F. HW-6
1. Doors: 105A, 108, 112, 205, M100
2. Set Includes:

3 EA	BUTT HINGES
1 EA	INT. LEVER W/LOCK
1 EA	INT. LEVER

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

G. HW-7
1. Doors: 201A, 206
2. Set Includes:

3 EA	BUTT HINGES
1 EA	INT. LEVER W/LOCK
1 EA	INT. LEVER

3. Salvage and Reinstall: Door in new location
4. Existing hardware to remain: None.

H. HW-8
1. Doors: 202, M103
2. Set Includes:

3 EA	BUTT HINGES
1 EA	INT. LEVER W/LOCK
1 EA	INT. LEVER

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

I. HW-9
1. Doors: 200A
2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	INT. LEVER

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

J. HW-10
1. Doors: 200C, 204
2. Set Includes:

2 EA	BUTT HINGES
1 EA	INT. LEVER W/LOCK
1 EA	INT. LEVER

3. Salvage and Reinstall: None.

4. Existing hardware to remain: None.

3.03 SWING DOORS -- NOT REQUIRING KEY LOCKING

A. HW-11
1. Doors: 102, 115A, 115B
2. Set Includes:

3 EA	BUTT HINGES
2 EA	INT. LEVER

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

3.04 SWING DOORS - KEY REQUIRED TO LOCK, MAY BE LEFT UNLOCKED, PRIVACY FUNCTION

A. HW-12
1. Doors: 106, 107, 203
2. Set Includes:

3 EA	BUTT HINGES
1 EA	INT. LEVER
1 EA	PUSH HANDLE
1 EA	INDICATOR LOCK

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

B. HW-13
1. Doors: 117, 118, 119
2. Set Includes:

3 EA	BUTT HINGES
1 EA	EXT. LEVER W/LOCK
1 EA	PUSH HANDLE
1 EA	INDICATOR LOCK
1 EA	THRESHOLD
1 SET	WEATHERSTRIPPING

3. Salvage and Reinstall: None.
4. Existing hardware to remain: None.

C. HW-14
1. Doors: M102
2. Set Includes:

1 EA	INT. LEVER
1 EA	PUSH HANDLE
1 EA	INDICATOR LOCK

3. Salvage and Reinstall: Existing door in same location
4. Existing hardware to remain: None.

3.05 SLIDING DOORS - KEY REQUIRED TO LOCK, MAY BE LEFT UNLOCKED

A. HW-15
1. Doors: 114, 201B
2. Set Includes:

1 EA	FLUSH PULL
1 SET	DOOR TRACK HARDWARE, SEE SECTION 08 1473

3. Salvage and Reinstall: None.

4. Existing hardware to remain: None.

3.06 GATES - KEY REQUIRED TO LOCK, MAY BE LEFT UNLOCKED

A. HW-16
   1. Gates: G1, G2, G3
   2. Set Includes:

3 EA	BUTT HINGES
2 EA	EXT. LEVER
1 EA	DEADBOLT

   3. Salvage and Reinstall: None.
   4. Existing hardware to remain: None.

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL V.25

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Fully tempered insulating glass units.

C. Glazing units to be installed in window or door assemblies.

D. Monolithic interior glass.

E. Plastic sheet glazing units.

F. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

E. ASTM C1036 - Standard Specification for Flat Glass; 2011.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2013.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

K. ASTM E2188 - Standard Test Method for Insulating Glass Unit Performance; 2010.

L. ASTM E2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units; 2010.

M. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

N. GANA (GM) - GANA Glazing Manual; 2009.

O. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

P. GANA (SM) - GANA Sealant Manual; 2008.

Q. ICC (IBC) - International Building Code; 2015.

R. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

S. ITS (DIR) - Directory of Listed Products; current edition.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

U. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2012.

V. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

W. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

X. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

Y. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

Z. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

AA. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

BB. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

CC. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.07 MOCK-UPS

A. Include glazing in mock-ups specified in other Sections, including glass and air barrier and vapor retarder seal.

B. Locate where directed.

C. Mock-ups may remain as part of the Work.

1.08 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.09 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7 or no less than as indicated on structural plans for building ultimate wind speed.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/200 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.
   2. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.02 PERFORMANCE REQUIREMENTS - INTERIOR GLAZING

A. Provide type and thickness of interior glazing assemblies to support assembly dead loads, and to withstand live loads caused by interior use of building acting normal to plane of glass.
   1. Design Pressure: Calculated at no less than 5 psf or as required by code.
   2. Glass thickness listed are minium. Adjust thickness of glass to limit delection to no less than L/175 or greater as required by code.

2.03 MONOLITHIC GLASS

A. Manufacturers:
   1. AGC Glass North America, Inc: www.agcglass.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   5. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass, General:
   1. Kind FT - Fully Tempered Type: Complies with ASTM C1048. Provide where safety glass is indicated or required
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria. Provide for safety glazing used in hazardous locations.

C. Type GL-1 - Monolithic Safety Glazing: Non-fire-rated.
   1. Applications: Provide this type of glazing in the following locations, non-fire rated:
      a. Glazed lites in interior doors and sidelights.
      b. Other locations required by applicable federal, state, and local codes and regulations.

2. Glass Type: Fully tempered safety glass as specified.
3. Tint: Clear or as indicated.
4. Thickness: 1/4 inch, nominal, mimum. Reference performance requirements.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
1. Cardinal Glass Industries; _____: www.cardinalcorp.com/#sle.
2. Guardian Glass, LLC; _____: www.guardianglass.com/#sle.
3. Vitro Architectural Glass (formerly PPG Glass); _____: www.vitroglazings.com/#sle.
4. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Insulating Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace and complying with ASTM E2188 / ASTM E2189 .
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements
2. Provide Kind FT (fully tempered) glass lites where safety glass is indicated or required.
3. Durability: Certified by an independent testing agency to comply with ASTM E2190.
4. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
5. Metal Edge Spacers: Aluminum, bent and soldered corners.
6. Spacer Color: Black.
7. Edge Seal:
   a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   b. Color: Black.

C. Type IG-1 - High-performance Insulating Glass Units: Vision glass, double glazed, for specified locations.
1. Basis-of-Design: Vitro Glass "Solarban 90 (2) Starphire + Starphire".
2. Applications: Provide this type of glazing in the following locations:
   a. Exterior windows at Garden Room 115.
3. Space between lites filled with argon.
4. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Low-e coating on #2 surface.
5. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.24, nominal.
8. Visible Light Transmittance (VLT): 54 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.23, nominal.
10. Visible Light Reflectance, Outside: 13 percent, nominal.
11. Glazing Method: Dry glazing method, gasket glazing.

D. Type IG-2 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Provide this type of glazing in the following locations"
   a. Glazed lites in all exterior windows, unless specified otherwise.
   b. Other locations indicated on drawings.
2. Applications: Typical all ____ Exterior glazing locations unless specifically noted otherwise.
3. Space between lites filled with air.
4. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.

b. Coating: Low-e coating on #2 surface
5. Inboard Lite: Annealed float glass, 1/4 inch thick, minimum.
a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.29, nominal.
8. Visible Light Transmittance (VLT): 51 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.35, nominal.
10. Glazing Method: Dry glazing method, gasket glazing.

E. Type IG-3 - Insulating Glass Units: Safety glazing.
1. Applications: provide this type of glazing in the following locations:
a. Glazed lites in all exterior doors.
b. Glazed sidelights and panels next to exterior doors.
c. Other locations required by applicable federal, state, and local codes and regulations.
d. Other locations indicated on drawings.
2. Space between lites filled with air.
3. Glass Type: Same as Type IG-2 except use fully tempered float glass for both outboard and inboard lites.
a. Tint: Clear.
b. Coating: Low-e coating on #2 surface.

2.05 PLASTIC SHEET GLAZING UNITS

A. Type P-1 - Multi-wall Polycarbonate Sheet: Ultraviolet (UV) stabilized.
1. Comply with requirements in Section 13 3413.13 - Greenhouses.

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot ; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that the minimum required face and edge clearances are being provided.

C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building. Follow window assembly manufacturer instructions for placement of glazing.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact. Apply sealant at corners as necessary to ensure gasket has full contact.

3.05 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

F. Carefully trim protruding tape with knife.

3.06 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact. Apply sealant at corners as necessary to ensure gasket has full contact.

G. Carefully trim protruding tape with knife.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 9100
LOUVERS AND VENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 4623 - Wood Siding.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 09 9113 - Exterior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, tolerances; head, jamb and sill details; blade configuration, screens, blankout areas required, and frames.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
   1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
   2. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   3. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with concealed intermediate mullions.
   1. Blades: Straight.
   2. Frame: 4 inches deep, channel profile; corner joints mitered and , with continuous recessed caulking channel each side.
   3. Aluminum Thickness: Frame 12 gage, 0.0808 inch minimum; blades 12 gage, 0.0808 inch minimum.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).
   1. Color Anodizing: AAMA 611 Class I, AA-M12C22A42/44.

B. Formed Aluminum: Formed sheet, ASTM B209 (ASTM B209M).

1. Color Anodizing: AAMA 611 Class I, AA-M12C22A42/44.

C. Bird Screen: Interwoven wire mesh of steel, 0.063 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Insect Screen: 18 x 16 size aluminum mesh.

2.03 FINISHES

A. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils thick.

B. Color: As selected from manufacturer's standard colors.

2.04 ACCESSORIES

A. Fasteners and Anchors: Galvanized steel.

B. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

D. Sealant: As specified in Section 07 9200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

E. Install perimeter sealant in accordance with Section 07 9200.

3.03 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

SECTION 09 0160
WOOD FLOORING RESTORATION

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes procedures for protection, cleaning, repair and refinising of existing wood strip flooring.

1.02 REFERENCES

A. "Wood Finishing and Refinishing Revised Edition," by S.W. Gibbia, New York: Van Nostrand Reinhold Co., 1971.

1.03 DEFINITIONS

A. Refinishing is defined as all the process(es) necessary to restore woodwork. Stripping is defined as the process of removing existing coatings from woodwork without damage to the wood. Finishing is defined as the process of applying stain and protective coating and all related preparatory and follow-up tasks. Cleaning is defined as the removal of dirt embedded in the upper finish layers and does not include the removal of any finish layer.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing Work of this Section.
   1. Require attendance of parties directly affecting work of this section
   2. Review conditions of Work, including protection procedures, cleaning procedures, repair procedures, floor refinishing and protection, and coordination with related work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each product or system indicated. Include manufacturer’s product literature, application instructions, VOC content, and Safety Data Sheets (SDS) for all products used. Include test data, if applicable, substantiating those products comply with requirements.

C. Maintenance Data: For maintenance of floor finishes. Submit with Project Close-out Documents.

D. Extra Materials: 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. Wood Flooring: Equal to 1 percent of amount installed for each type of wood flooring indicated.

1.06 QUALITY ASSURANCE

A. General Objective: The objective of wood flooring restoration is to provide wood flooring with a smooth, uniform appearance, consistent with the original design intent, and to preserve the inherent patina. Splotches, streaks, runs, or any other kind of spotty appearance shall not be accepted. Too aggressive cleaning or sanding shall not be accepted.

B. Restoration Specialist Qualifications: Engage an experienced contractor having a minimum of five years of experience in this field to perform the Work of this Section.
   1. Firm shall meet the minimum required skills requirements stipulated below:
      a. Wood strip flooring repair and replacement.
      b. Sourcing and fabricating replacement floor boards to match existing.
      c. Stripping, staining and refinishing wood flooring.
   2. Provide examples of three projects completed commendably within th elast 6 years which are similar in size and complexity to this Project. Include project reference with contact information.

C. AWI Quality Standard: Comply with AWI's "Manual of Millwork" for construction, finishes, grades of wood windows, and other requirements.

D. Hardwood Flooring: Comply with NOFMA's "Official Flooring Grading Rules" for species, grade, and cut.

E. Source Limitations: Obtain each type of material from a single source, with resources to provide materials of consistent quality in appearance, physical properties, characteristics, and performance.

F. Regulatory Requirements: Comply with municipal, State and Federal regulations governing the refinishing operations and chemical waste disposal.

1.07 MOCK-UP(S)

A. Prepare mock-up(s) to demonstrate aesthetic effects and to set quality standards for materials and execution.

B. Floor Refinishing Mockup: Prepare and refinish one (1) sample area for approval by the Architect or designated representative.
   1. Sample areas to be minimum 10-feet by 10-feet in size.
   2. Locate mock-up(s) where directed.
   3. Acceptable panels and procedures employed will become the standard for work of this section.
   4. In the case of rejection of the sample areas, these locations shall be re-stripped and refinished until approved by the Architect.
   5. Maintain approved mockup during construction in an undisturbed condition. Provide temporary protection as required to prevent incidental damage, or damage incurred due to the work of other trades, until Substantial Completion of the Project.
   6. Approved Mock-ups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, identified with product information.

B. Before delivering new wood materials to Project site, ensure that spaces are enclosed and well-ventilated and that humidity is at approximate level for occupancy.

C. Store wood materials in clean, dry, ventilated areas inside building. Protect wood materials from damage or exposure to moisture.

D. Maintain ambient temperatures at approximate levels for occupancy from five days before delivery of flooring through completion of Work. Until final acceptance of building, maintain minimum temperature of 50 deg F.

E. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

F. Maintain containers in clean condition, free of foreign materials and residue.

G. Store materials in original, undamaged containers in clean, dry, ventilated, protected location, within temperature range required by manufacturer. Protect stored materials from direct sunlight, weather and surface contaminants.

H. Handle materials to avoid damage.

I. Conspicuously mark damaged or opened containers, or containers with contaminated materials, and remove from Project site. Remove and replace materials that cannot be applied within stated shelf life.

J. Remove used rags and construction waste from Project site daily.

1.09 PROJECT CONDITIONS

A. Environmental Requirements: Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation

1. Environmental Conditioning: Maintain an ambient temperature between 65 and 75 deg F (18 and 24 deg C) and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
    a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.
    b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
3. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bona Flooring Products; www.bona.com.

B. Butcher's Wax; store.bwccompany.com.

C. 3M Consumer Products Group; www.3m.com.

D. The Sherwin Williams Company; www.sherwinwilliams.com.

2.02 WOOD REPAIR MATERIALS

A. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content, tongue and groove and end matched, and with backs channeled.
    1. Species and Grade: Match existing.
    2. Cut: Quarter/rift sawn.
    3. Thickness: 3/4 inch (19 mm).
    4. Face Width: 2-1/4 inches.
    5. Lengths: Random-length strips complying with applicable grading rules.

B. Wood Filler: Compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved Samples, provide pigmented filler.

2.03 REFINISHING MATERIALS

A. Commercial Paint and Varnish Remover such as "Citristrip" (Specialties Environmental Technologies, Inc.), "Safest Stripper" (3M), or approved equal

B. Mineral Spirits:
    1. A petroleum distillate that is used especially as paint or varnish thinner.
    2. Other chemical or common names include Benzine* (not Benzene); Naphtha*; Petroleum spirits*; Solvent naphtha*.
    3. Potential Hazards: TOXIC AND FLAMMABLE.
    4. Safety Precautions:
        a. AVOID REPEATED OR PROLONGED SKIN CONTACT.
        b. ALWAYS wear rubber gloves when handling mineral spirits.
        c. If any chemical is splashed onto the skin, wash immediately with soap and water.
    5. Available from construction specialties' distributor, hardware store, paint store, or printer's supply distributor.

        -OR-

    6. Turpentine:
    7. Typically used as a solvent and thinner.
    8. Potential Hazards: TOXIC AND FLAMMABLE.
    9. Safety Precautions:
        a. Work in a well ventilated area.
        b. Observe safety rules as turpentine is flammable, and the fumes can trip an ionization smoke detection system.

c. Store soiled cloths in a metal safety container to guard against spontaneous combustion.

10. Available from hardware store or paint store.

-OR-

Solvent Wax Remover such as "Woodline Renovator" (Bonakemi USA, Inc.), or approved equal.

C. Wood filler in color to match original stain.
   1. CAUTION: WOOD FILLERS CONTAINING A LINSEED OIL VEHICLE MAY CAUSE WHITE SPOTS TO DEVELOP IN THE LACQUER FINISH COAT.

D. Oil stain or universal stain (Sherwin Williams), or approved equal.

E. Alkyd or urethane-base satin varnish (Sherwin Williams), or approved equal.

F. Paste wax (non-yellowing) such as "Butcher's Paste Wax" (Butcher Polish Company), or approved equal.

G. Wood Filler Paste: Color of fill to match color of wood.
   1. Provide one of the following or approved equal:
      a. Minwax Wood Filler
      b. Elmers Fill N Finish.
      c. Dap Plastic Wood Filler.

2.04 MISCELLANEOUS MATERIALS

A. Provide all tools and miscellaneous materials to perform the Work, which may include but not limited to the following:
   1. 000 steel wool
   2. Steel or brass wire brushes
   3. Stiff fiber bristle brushes
   4. Putty knife or broad knife
   5. Clean, dry cloths (cheese cloth or gauze)
   6. Orbital Sander
   7. Electric floor polisher
   8. Nylon web scrubbing pads
   9. Lamb's wool buffing pads

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.

B. Inspect all wood surfaces to be treated. Following cleaning, mark wood damage or finish loss areas to be repaired with painter’s tape or other non-permanent marking method.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PROTECTION

A. Install temporary protection materials or covers as required to protect persons, building, and surrounding surfaces from harm resulting from historic treatment.

B. Exercise caution in performing the Work so as not to damage adjacent materials. Protect building materials from mechanical damage due to scaffolding or other equipment.

C. Cover adjacent surfaces with materials that are proven to resist products being used unless products will not damage adjacent surfaces.

3.03 FLOOR REPAIR

A. Minor Repairs: Fill and repair wood flooring seams and defects.

1. Fill gouges or scratches equivalent to or greater than 1/16-inch wide by 2 inches long by 1/16-inch deep with wood filler.
2. Remove extraneous or abandoned nails, screws, staples or other mechanical fasteners no longer in use.
3. Fill and prepare any resulting holes with wood filler, and finish flush with surface.
4. Refasten loose elements with new finish nails. Set nail heads below surface, fill with wood filler and finish flush with surface.
5. Apply the approved wood filler according to the manufacturer's instructions. After curing, sand the filled area even with the existing wood surface.
6. Finished appearance of fill material shall be consistent with surrounding wood surfaces, rendering the repair work unnoticeable.

B. Installation of Solid-Wood Flooring:
1. Blind nail or staple flooring to substrate.
2. For flooring of face width more than 3 inches (75 mm):
   a. Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.

3.04 FLOOR REFINISHING

A. Remove Existing Coating:
1. Work in areas approximately 4' by 4' at one time.
   NOTE: DO NOT USE WATER ON THE WOOD SURFACE.
2. Special Procedures for Varnished Wood Floors:
   a. Chemical strip entire floor (Heavy power sanding will not be allowed.) Multiple applications of stripper might be required to remove finish coat and stain. To prepare for restaining and new finish coat, lightly sand any area where the grain has been raised due to the application of the stripper.
      NOTE: DO NOT REMOVE MORE THAN 1/16" OF THE WOOD SURFACE.
   b. Remove dust from floor with vacuum and tack cloth.
3. Special Procedures for Waxed Wood Floors:
   NOTE: Some sophisticated modern waxes, formulate for long wear and for high production commercial use, require special strippers that most often are not appropriate for historic materials because the ingredients cannot be readily detected. Some silicon waxes can only be removed by abrasion.
   NOTE: WORK IN A WELL-VENTILATED ROOM. OBSERVE SAFETY RULES AS BOTH THE TURPENTINE AND THE WAX ARE FLAMMABLE, AND THE FUMES CAN TRIP AN IONIZATION SMOKE DETECTION SYSTEM. STORE SOILED CLOTHS IN A METAL SAFETY CONTAINER TO GUARD AGAINST SPONTANEOUS COMBUSTION.
   a. Dampen small area of floor with turpentine or mineral spirits, or apply wax remover evenly over the floor following manufacturer's instructions.
   b. Using a 16" electric floor machine, scrub lightly with a piece of 000 steel wool or nylon web scrubbing pad. Change steel wool or pads as they become clogged with old wax.
   c. Wipe up solvent and wax with clean cloths.
   d. Continue cleaning in this manner until all of the old wax has been removed. Allow floor to dry, approximately 15-20 minutes after the last area has been cleaned.
   e. Apply wax and buff. Apply two or more thin coats rather than one thick coat. Buff after each coat.

B. Fill scratches, gouges and dents with wood filler.

C. Apply a high quality paste wood filler with a brush to all open grain wood species (i.e., Oak) before staining.
1. Dampen a clean cloth with mineral spirits and wipe the paste off across the grain of the wood to enable the filler to remain in the grain depressions.

2. Allow the filler to fully dry before applying the stain or varnish.

D. Stain and Varnish the Wood:
   1. On a SAMPLE area 12 inches square, brush apply oil stain or universal stain.
   2. Allow the stain to penetrate the wood for at least 5-10 minutes.
   3. Remove excess stain with a clean, lint-free cloth. Rub the wood parallel to the grain.
   4. Allow the stain to dry at least 12 hours before applying varnish.
   5. Brush apply one coat of alkyd or urethane-base satin varnish. Varnish should be thin, but not watery.
   6. Allow to dry for at least 24 hours.
   7. When dry, buff the surface with 000 steel wool and dry-brush with a fiber bristle brush to remove any metal particles left behind from the steel wool. A tack rag may also be used to remove dust from the surface.
   8. Apply second coat of satin varnish (full-strength).
   9. Allow to fully dry.
   10. Buff the surface with 000 steel wool and dry-brushwith a fiber bristle brush to remove any metal particles left behind from the steel wool.
   11. If sample is approved by architect, follow the same procedures for all remaining wood.
   12. For areas subject to wear (i.e., handrails, wainscot, etc.):
      a. After buffing the final coat of varnish, apply one coat of non-yellowing paste wax.

3.05 PROTECTION AND CLEAN-UP

A. Provide protection for completed floors until the completion of construction. Cover floors as required or close to foot traffic. Surfaces damaged by construction operations shall be repaired or refinished at no cost to Owner

B. The premises shall be kept in clean and orderly condition at all times during the progress of the work. Rubbish, barriers, dirt, debris, tools, equipment, and unused materials shall be removed from the site each day.

C. Remove all protection materials carefully and thoroughly. Protection materials shall not damage or leave residue on surfaces. Materials to which protection was attached shall be left in the same condition as before the Work.

D. Repair any building materials that have been damaged by the Work to the satisfaction of the Architect and without additional cost to the Owner.

END OF SECTION

SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Broadloom carpet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

H. Remedial floor sheet membrane.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.03 ADMINISTRATIVE REQUIREMENTS

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

1.04 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

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

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.

4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI (RWP).

1.05 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing will be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Owner when specified ambient conditions have been achieved and when testing will start.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.07 FIELD CONDITIONS

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

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: 1/8 inch, maximum.

2. Products:
    a. ARDEX Engineered Cements; ARDEX MC RAPID: www.ardexamericas.com/#sle.
    b. Floor Seal Technology, Inc; MES 100 with Floor Seal FloorCem SLU: www.floorseal.com/#sle.
    c. Sika Corporation; Sikafloor Moisture Tolerance Epoxy Primer and Sikafloor Self-Leveling Moisture Tolerant Resurfacer: www.sikafloorusa.com/#sle.
    d. Tnemec Company, Inc; Series 208 Epoxoprime MVT: www.tnemec.com/#sle.

C. Remedial Floor Sheet Membrane: Pre-formed multi-ply sheet membrane installed over concrete subfloor and intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
1. Thickness: 28 mil (0.028 inch).
2. Tape: Types recommended by underlayment manufacturer to install membrane and cover seams.
3. Products:
    a. GCP Applied Technologies; Kovara MBX: www.gcpat.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection.

B. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

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

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
   1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
   2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
   3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

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

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 INSTALLATION OF REMEDIAL FLOOR SHEET MEMBRANE

A. Install in accordance with sheet membrane manufacturer's instructions.

END OF SECTION

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal partition and soffit framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

H. Framing Accessories.

1.02 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

C. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

J. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

M. ASTM E413 - Classification for Rating Sound Insulation; 2010.

N. GA-216 - Application and Finishing of Gypsum Board; 2013.

O. GA-600 - Fire Resistance Design Manual; 2015.

P. UL (FRD) - Fire Resistance Directory; current edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.
   1. Indicate special details associated with fireproofing and acoustical seals.

2. Indicate component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.
3. Describe method for securing studs to track, splicing, and for blocking and reinforcing of framing connections.
4. Provide partition legend indicating proposed assembly components at each partition type.

C. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system. Include framing load charts and limitations.

D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

E. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of documented experience.

1.05 MOCK-UP

A. Provide mock-up of stud wall, ceiling, and soffit framing including insulation, sheathing, window frame, and door frame and finish specified in other sections. Coordinate installation of associated work specified in other sections.
1. Mock-up may remain part of finish work.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
1. See PART 3 for finishing requirements.

B. Interior Partitions, Indicated as Acoustic and/or STC on partition schedule: Provide completed assemblies with the following characteristics:
1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
2. Treat all penetrations and perimeters of wall assembly with acoustical sealant, both sides of wall.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Shaft Walls at Elevator Shafts: Provide completed assemblies with the following characteristics:
1. Air Pressure Within Shaft: Intermittent loads of 5 lbf/sq ft with maximum mid-span deflection of L/240.
2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

E. Fire Rated Assemblies: Provide completed assemblies as indicated on partition schedule and complying with applicable code.
1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
1. ClarkDietrich: www.clarkdietrich.com/#sle.

2. Marino: www.marinoware.com/#sle.
3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf, with steel thickness not less than 20 gauge (30 mils). Adjust steel thickness to comply with deflection with stud heights. Walls with tile or masonry veneer, comply with deflection of wall framing of L/360 at 5psf.
1. Studs: "C" shaped with knurled or emobossed faces.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.

C. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

E. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs.

F. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.

G. Metal Framing Fasteners: ASTM C1002 self-piercing tapping screws.

H. Sheet Metal Backing: 0.036 inch thick, galvanized.

I. Partial Height partitions: Use steel wall stiffeners bolted to floor surface and stud framing at 48" o.c., minimum of two per wall. Provide No-Flex Stud Stiffeners, or approved equal. www.noflex.com.

J. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.
1. Products:
a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
1. American Gypsum Company: www.americangypsum.com/#sle.
2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. Temple-Inland Building Product by Georgia-Pacific, LLC: www.temple.com.
5. USG Corporation: www.usg.com/#sle.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for standard vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
b. Mold resistant board is required at all toilet rooms, janitor closets, laundry rooms, kitchen and similar wet areaat all wet locations such as: Locker, shower, toilet rooms, kitchens, janitor closets, etc and behind plumbing fixtures locations. Also refer to partition schedule and locations otherwise noted.
3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:

a. Vertical Surfaces: 5/8 inch.
b. Ceilings: 5/8 inch., sag resistant.

5. Paper-Faced Products:
   a. American Gypsum Company; LightRoc Gypsum Wallboard.
   b. Georgia-Pacific Gypsum; ToughRock.
   c. Georgia-Pacific Gypsum; ToughRock Fireguard X.
   d. Georgia-Pacific Gypsum; ToughRock Fireguard C.
   e. Substitutions: See Section 01 6000 - Product Requirements.
6. Mold Resistant Paper Faced Products:
   a. American Gypsum Company; M-Bloc.
   b. Continental Building Products; Mold Defense Type X.
   c. Georgia-Pacific Gypsum; ToughRock Mold-Guard.
   d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
   e. National Gypsum Company; Gold Bond XP Gypsum Board.
   f. Lafarge North America Inc; Mold Defense Drywall.
   g. National Gypsum Company; Gold Bond Brand XP Gypsum Board.
   h. Temple-Inland Building Product by Georgia-Pacific, LLC; ComfortGuard Mold Resistant Gypsum Board.
   i. USG Corporation; Sheetrock Brand Mold Tough Gypsum Panels.

C. Tile Backer Board: As specified in section 09 3000.

D. Exterior Sheathing Board: As specified in Section 06 1000.

E. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
   1. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.04 GYPSUM WALLBOARD ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 2100.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.

D. Water-Resistive Barrier: As specified in Section 07 2500.

E. Finishing Accessories: ASTM C1047, galvanized steel, pre-approved rigid plastic, rolled zinc, pre-approved rigid plastic, or pre-approved rigid plastic, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.
   2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead at exposed panel edges.
   3. Products:
      a. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
      b. Trim-tex, Inc: www.trim-tex.com/#sle.
      c. Fry Reglet Corporation; www.fryreglet.com
      d. Substitutions: See Section 01 6000 - Product Requirements.

F. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Joint Compound: Drying type, vinyl-based, ready-mixed.
   4. Joint Compound: Setting type, field-mixed.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

2.05 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Verify existing conditions before starting work.

C. Verify that rough-in utilities are in proper location.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.
   1. Laterally brace entire suspension system.

C. Studs: Space studs at 16 inches on center or as otherwise scheduled.
   1. Extend partition framing to structure in all locations or as otherwise specifically noted on partition schedule.
   2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
   3. Align stud web openings horizontally.
   4. Secure studs to track using fastener method. Do not weld.
   5. Stud splicing is not permissible.
   6. Fabricate corners using a minimum of three studs.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jamb, not more than 2 inches from each side of opening. Refer to framing details on plans.

E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
   1. Orientation: Horizontal.
   2. Spacing: As indicated.

F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.

G. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.

H. Blocking: Coordinate installed bucks, support systems, anchors and blocking with electrical, mechanical and other work to be placed within or behind stud framing. Install wood blocking for support of:
   1. Wall-mounted cabinets.
   2. Plumbing fixtures.
   3. Toilet partitions.
   4. Toilet accessories.
   5. Wall-mounted door hardware.

3.04 CEILING AND SOFFIT FRAMING

A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

B. Install furring independent of walls, columns, and above-ceiling work.

C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflections to criteria indicated. Use rigid hangers at exterior soffits.

D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap spice securely.

E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls and rigid secure. Lap splices securely.

G. Laterally brace suspension system.

3.05 ACOUSTIC ACCESSORIES INSTALLATION

A. Install insulation material type as indicated in 07 2100 into partition cavities.

B. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions. At locations in stud cavities not covered by sheetrock, install strapping or retainer wires to hold insulation in place.

C. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.06 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Mold Resistant Gypsum Board: Use at all wall and ceiling surfaces in toilet rooms, janitor closets, laundry rooms, kitchens, and similar wet areas not indicated to receive wall tile.
   1. At single plumbing fixtures locations: Install from floor to 24 inches vertically above fixture and 12 inches horizontally past edge of fixture.

F. Tile Backer Board: Install at all locations scheduled to receive tile. Seal all joints penetrations through backer board with sealant. Install in accordance with ANSIO A108.11 and manufacturer's instructions.

G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

H. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

3.07 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
   2. Not more than 30 feet apart on ceiling over 50 feet long and/or where framing changes directions.
   3. At exterior soffits, not more than 30 feet apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on the drawings. Provide vent area specified or no less than 1/150 of area vented.

3.08 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish, walls behind specialty dry-erase coatings and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction. Installation must conform to UL or STC ratings at Fire Rated and Acoustical Partitions.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.
   2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
   3. Taping, filling and sanding is not required at base layer of double layer applications, unless required by UL fire resistance rating.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.09 QUALITY CONTROL

A. Prior to installation of wall board on stud walls, coordinate review with Architect and AHJ inspections and approvals.

B. Prior to covering up with suspended ceilings, coordinate above ceiling review with Architect. Review to observe installation of acoustical sealant, fire wall installation and labels, mechanical equipment installation and clearances, etc. Coordinate with AHJ inspections and approvals.

3.10 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000
TILING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Tile for floor and wall applications.

B. Backer board as tile substrate.

C. Stone thresholds.

D. Ceramic accessories, ceramic and non-ceramic trim.

1.02 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.

B. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

C. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).

D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

L. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2017.

M. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).; 2017.

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

O. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

P. ANSI A137.2 - American National Standard Specifications for Glass Tile; 2013.

Q. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2013.

R. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2015.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers. Have all materials to be used in installation at jobsite for observation.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details, and TCNA installation method details.

D. Samples: Mount tile and apply grout on one plywood panels, minimum 36 x 36 inches in size illustrating pattern, color variations, and grout joint size variations. Provide sample boards of tile color ranges for selection.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 1 percent of each size, color, and surface finish combinationbut not less than 10 of each type.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

C. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.
      a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Ceramic Mosaic Tile, Type CRT-01: ANSI A137.1, standard grade.
   1. Size: 0.78 by 17.71 inch, nominal.

2. Surface Finish: Glazed, Glossy.
3. Color(s): Apple Green.
4. Mounted Sheet Size: 5 by 18 inches.
5. Products:
    a. Tilebar; Kanbina: www.tilebar.com.
6. Contact: Lisa Perkowski, lperkowski@tilebar.com, (512) 422-1364

B. Porcelain Tile, Type PCT-01: ANSI A137.1 standard grade.
1. Provide material cost allowance of $25 per square foot. This does not include dealer mark-up, installation materials, or labor.

C. Natural Stone Tile, Type MBT-01:
1. Single Tiles:
    a. Size: 12 by 24 inch, nominal.
    b. Thickness: 12.7 mm.
2. Face: Smooth.
3. Surface Finish: Honed.
4. Edges: Square.
5. Color(s): Light Beige.
6. Products:
    a. Tilebar; Aero Cream: www.tilebar.com.
7. Contact: Lisa Perkowski, lperkowski@tilebar.com, (512) 422-1364

D. Natural Stone Tile, Type MBT-02.
1. Single Tiles:
    a. Size: 3 by 12 inch, nominal.
    b. Thickness: 9.53 mm.
2. Face: Smooth.
3. Surface Finish: Polished.
4. Edges: Square.
5. Color(s): Light Beige.
6. Products:
    a. Tilebar; Aero Cream: www.tilebar.com
7. Contact: Lisa Perkowski, lperkowski@tilebar.com, (512) 422-1364

E. Mirrored Glass Tile, Type GLT-01: ANSI A137.2 standard grade.
1. Large Format Tiles:
    a. Size: 6 by 18 inch, nominal.
    b. Thickness: 8 mm.
2. Edges: Square.
3. Color(s): Argenta Gray .
4. Products:
    a. Tilebar; Vilna: www.tilebar.com.
5. Contact: Contact: Lisa Perkowski, lperkowski@tilebar.com, (512) 422-1364

2.02 TRIM AND ACCESSORIES

A. Stone Threshold: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Non-Ceramic Trim: color-coated aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
    a. Open edges of wall tile.
    b. Open edges of floor tile.
    c. Transition between floor finishes of different heights, including door thresholds.
    d. Borders and other trim as indicated on drawings.
2. Color: Cusom RAL, up to 4 colors will be used.

3. Manufacturers:
    a. Schluter-Systems: www.schluter.com.
4. Contact: BPI; Gwyn Noland; gnoland@bpiteam.com; (214) 537-8973

2.03 SETTING MATERIALS

A. Provide setting materials made by the same manufacturer as grout.
1. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
    a. Products:
        1) Custom Building Products; MegaLite Ultimate Crack Prevention Large Format Tile Mortar: www.custombuildingproducts.com/#sle.
        2) LATICRETE International, Inc; LATICRETE 254 Platinum: www.laticrete.com/#sle.
2. Glass Tile Adhesive: ANSI A136.1, thin-set polymer fortified adhesive type.
    a. Use Type I in areas subject to prolonged moisture exposure.
    b. Products: LATICRETE Glass Tile Adhesive
    c. Color: White only.

B. Contact: BPI; Gwyn Noland; gnoland@bpiteam.com; (214) 537-8973

2.04 GROUTS

A. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
1. Applications: All locations, except in prep kitchen.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
    a. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
4. Industrial Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout, and ANSI A118.5 chemical resistant furan resin grout.
    a. Location: Kitchen and Prep Kitchen area.
    b. Color(s): As selected by Architect from manufacturer's full line.
    c. Products:
        1) LATICRETE International, Inc; LATICRETE Spectralock 2000 IG: www.laticrete.com.

B. Contact: BPI; Gwyn Noland; gnoland@bpiteam.com; (214) 537-8973

2.05 ACCESSORY MATERIALS

A. Waterproofing Membrane at Floors and Walls: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
    a. Material: Synthetic rubber or Acrylic.
    b. Thickness: 25 mils, minimum, dry film thickness.
    c. Products:
        1) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
    d. Contact: BPI; Gwyn Noland; gnoland@bpiteam.com; (214) 537-8973

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

C. Backer Board: Coated glass mat type complying with ASTM C1178/C1178M; inorganic fiberglass mat on both surfaces and integral acrylic coating vapor retarder.
1. Standard Type: Thickness 1/2 inch.
2. Fire Resistant Type: Type X core, thickness 5/8 inch.

D. Mesh Tape: 2 inch wide self-adhesive fiberglass mesh tape.

E. Self Leveling underlayment System: Cement based underlayment and primer.

1. Laticrete International; Level & Primer: www.laticrete.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances. Use self-level

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of color as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installation.

F. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protect coating, taking care not to coat unexposed tile surfaces.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings, unless otherwise noted.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Jointing Pattern: Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
   1. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Layout tile work and center tile fields in both directions in each wall area.
   2. Adjust tile to align with expansion joints in slabs and to minimize tile cutting.
   3. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

E. Expansion Joints: Locate sealant filled expansion control, contraction and isolation joints directly over existing joints during installation of setting materials, mortar beds and tile, except where permitted otherwise. Do not saw-cut joints after installing tiles.
   1. Locate joints in tile surfaces directly above joints in concrete surfaces or provide crack isolation membrane to realign joint. Reference details on drawings.
   2. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

F. Cap tile wainscots with bullnose trim matching wall tile. If bullnose trim is not available, provide aluminum trim or as indicated on drawings.

G. Form internal angles square and external angles bullnosed.

H. Install ceramic accessories rigidly in prepared openings.

I. Install non-ceramic trim in accordance with manufacturer's instructions.

J. Sound tile after setting. Replace hollow sounding units.

K. Keep control and expansion joints free of mortar, grout, and adhesive.

L. Keep expansion joints free of adhesive or grout. Apply sealant to joints.

M. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

N. Grout tile joints. Grout to comply with ANSI A108.10 tile installation standards.

O. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

P. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes. Apply sealant at corners of intersecting tile surfaces.

3.04 INSTALLATION - FLOORS & WALLS - WATERPROOF & CRACK-SUPPRESSION MEMBRANE

A. Install waterproofing and crack-suppression membrane to comply with ANSI A108.13 and membrane manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.

B. Do not install tile over waterproofing and crack suppression membrane until membrane has cured and been tested to determine that it is water tight.

C. Install waterproofing and crack suppression membrane below all ceramic tile at locations indicated. Note full-coverage embedded fabric reinforcement required regardless of manufacturer / product used.
   1. Provide at Shower Rooms, toilet rooms, restrooms, laundry rooms, janitor closets, kitchens and/or similar wet locations scheduled to receive tile.

D. Install waterproofing membrane underneath prefinished plumbing fixtures and/or units such as shower pans, shower units, hot tubs, toilets, mop sinks, sink basins, or similiar large floor mounted fixtures. Membrane to seal tight to all floor penetrations and piping to create complete waterproof assembly.

E. Install waterproofing membrane vertically on all walls a minimum of 4 inches around entire perimeter of rooms. Extend membrane vertically on wall surfaces beneath wall tile of showers and pre-made shower units to ensure water tight system.

3.05 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over exterior concrete substrates, install in accordance with TCNA (HB) Method F102, with epoxy grout.

B. Over interior concrete substrates, install in accordance with The Tile Council of North America Handbook Method F122, using waterproof membrane, thin-set latex-portland cement bond coat with epoxy grout.

3.06 INSTALLATION - WALL TILE

A. On exterior walls install in accordance with The Tile Council of North America Handbook Method W244, thin-set over cementitious backer units, with waterproofing membrane, with epoxy grout.

B. Over interior walls on cementitious backer units on studs, install in accordance with The Tile Council of North America Handbook Method W244using membrane where indicated, thin-set latex-Portland cement bond coat with epoxy grout.

C. Over interior concrete and masonry install in accordance with The Tile Council of North America Handbook Method W202, thin-set with dry-set or latex-Portland cement bond coat on waterproof membrane where indicated, with epoxy grout.

D. At glass tile installations: Over interior walls on cementitious backer units, install in accordance with the TCNA Handbook method W244C using white Glass Tile Adhesive with epoxy grout. Verify tile adhesive with glass tile manufacturer.

3.07 CLEANING

A. Clean tile and grout surfaces.

B. Clean and remove all residue from epoxy grout from surfaces of tile. Use professional cleaning solutions as required.

3.08 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100
ACOUSTICAL WOOD CEILINGS

PART 1 — GENERAL

1.01 1.1 DESCRIPTION OF WORK

A. Work Included: Provide ARCHITECTURAL COMPONENTS GROUP, INC. Wood Grille Backer Series 1 GB1 ceiling or wall system where shown on architectural drawings, and as specified in this specification.

1.2 QUALITY ASSURANCE

A. ARCHITECTURAL COMPONENTS GROUP, INC. Grille Backer GB1-xxxx-y wood system for this project shall maintain the quality as instituted by the architect or A.W.I.

B. Design Criteria: Manufacture of GB1-xxxx-y wood Grille Backer shall be installed true and plumb to within manufacturing tolerance of 1/8” within 8’ of length.

C. Product Construction: Wood shall be kiln dried to 10%. Cracking, checking and warpage of members will not be acceptable.

1.3 SUBMITTALS

A. Technical Data: Submit manufacturer’s data and installation instructions.

B. Shop Drawings: Submit 4 copies of shop drawings showing all areas involved, attachment conditions and perimeter circumstances.

C. Submittal Sample: Submit 1 product sample for approval by architect.

1.4 DELIVERY, STORAGE AND HANDLING

A. Material must be stored and installed only in secured ambient environment (humidity min. 25% - max. 55%, temperature not to exceed 86 degrees).

B. Windows, doors and all wet-work must be completed before unpacking and installation. Handle carefully to avoid damage.

PART 2 — PRODUCTS

5.01 2.1 ACCEPTABLE MANUFACTURER

A. ARMSTRONG: ARCHITECTURAL COMPONENTS GROUP, INC. 521 George St. Marshfield, MO 65706

B. Phone (417) 869-6777 Fax (417) 869-7888

2.2 PRODUCT TYPE

A. Product Configuration: Wood Grille Backer system product: GB1-xxxx-y
   1. Project Works No. 02547385
   2. Nomenclature for product GB1-8138-C:
      a. GB1 = Grille Backer Series 1
      b. 6 = number of blades per foot
      c. 100 = 1" deep
      d. E= 3/4” thick blades

B. Solid wood grille members shall be provided in fixed panel lengths of 2' up to 1' [in 1" increments] or as noted on drawings.

C. Wood Grille assembly: Factory-assembled with black backers at 12” on center.

D. Finish: Wood finish shall utilize ACGI clear finish with satin sheen or specify custom stain to match architect sample. Back of planks shall be factory sealed.

E. Wood species shall be white oak. Note: Veneer blades shall have matching edge banding on one long edge.

F. Certification: If solid wood, wood shall or shall not be FSC certified. If wood veneer, wood veneer shall or shall not be FSC certified, and the core material shall or shall not be FSC certified. If FSC, Chain of Custody shall or shall not be provided.

G. NAUF: If veneer, the substrate material shall or shall not be manufactured with no added urea formaldehyde.

H. Fire Rating: Grilles shall achieve a Class I(A)fire rating.

I. Attachment System: Grille Backer Wood Wall and Ceiling System shall be suspended according to manufacturers suggested method of suspension as per the design details provided in the plans.

PART 3 — EXECUTION

7.01 3.1 INSTALLATION

A. Wood Grille Backer ceiling or wall system shall be handled and installed with care in order to prevent surface and structure damage. Field cutting shall be kept to a minimum and performed as recommended by manufacturer.

B. The ceiling system shall be suspended by HD T-grid with main runners on 2’ centers and cross T’s every 4’.

C. Contractor shall clean all panels prior to installation according to manufacturer’s recommended maintenance procedures. Upon completion of installation, panels shall be inspected and cleaned as needed.

PART 4 — WARRANTY

8.01 4.1 PRODUCT WARRANTY

A. ARCHITECTURAL COMPONENTS GROUP, INC. shall warranty the wood Grille Backer ceiling or wall system against manufacturer’s defects up to one year. Changes in finish or dimensions due to ultra violet light, excessive temperature or humidity conditions and/or abuse of any kind shall void any warranties from ACGI.

B. Install conditions for the area should remain for the proper occupied conditions of humidity and temperature (humidity min. 25% - max. 55%, temperature not to exceed 86 degrees).

C. The contractor shall warranty for one year all work from final acceptance of completed work.

END OF SECTION

SECTION 09 5400
INTEGRATED CEILING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Acoustical ceiling panel

B. Wire hangers, fasteners, main runners, cross tees, and wall angle moldings

C. Perimeter Trim

D. Access Panels

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM A 1008 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

D. ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire

E. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

F. ASTM C 645 Standard Specification for Metal Suspension Systems

G. ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

H. ASTM C754 AND C1858 All installations should be in compliance with these tests.

I. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

J. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials

K. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint

L. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

M. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation between Rooms Sharing a Common Ceiling Plenum

N. ASTM E3090 All references to suspension component property testing per this test method.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide descriptions and characteristics of components, finishes, product limitations.

C. Shop Drawings: Layout and details of ceilings. Show locations of items that are to be coordinated with, or supported by the ceilings.

D. Samples: Minimum 6 x 6 inch samples of specified panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility: Provide acoustical panel units and grid components by a single manufacturer.

B. Fire Performance Characteristics: Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.

C. Surface Burning Characteristics: As follows, tested per ASTM E 84 and complying with ASTM E 1264 Classification.

1.05 FIELD CONDITIONS

A. Do not install system until building is enclosed, above ceiling work is completed, tested, and approved, and dust generating activities have terminated.

B. Building areas to receive ceilings shall be free of construction dust and debris. AcoustiBuilt panels should be installed in areas where the building is enclosed and the HVAC is continuously functioning. This product is not recommended for exterior applications, where standing water is present, or where moisture will come into direct contact with the ceiling.
   1. HVAC should be designed, installed, and operated in accordance with ASHRAE Standard 62.1. It is also necessary for the area to be enclosed, for the HVAC systems to be functioning, and in continuous operations for the life of the product. Product is not intended for use where natural ventilation is part of the ventilation strategy and not recommended in areas where a differential plenum pressure exists.

1.06 DELIVERY, STORAGE AND HANDLING

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

B. Before installing acoustical ceiling units, permit them to reach room temperature and a stabilized moisture content. Store all material within temperature limits required by manufacturer.

C. Handle acoustical ceiling units carefully to avoid chipping edges or damaged units in any way.

1.07 WARRANTY

A. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Manufacturer’s defects in material
   2. Grid System: Rusting and manufacturer's defects
   3. CastWorks Access Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period

B. Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion
   2. Suspension: Ten (10) years from date of substantial completion
   3. CastWorks Architectural Forms: One (1) year from date of substantial completion

C. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design AcoustiBuilt Seamless Acoustical Ceiling System:
   1. Armstrong World Industries, Inc.
   2. Finish:
      a. Joint Compound Finish by Others
      b. Spray Applied Finish by Armstrong World Industries, Inc.
   3. Suspension Systems: Armstrong World Industries, Inc.
   4. Perimeter Trim Systems: Armstrong World Industries, Inc.
   5. Soffit Construction: Armstrong World Industries, Inc. Drywall Grid SimpleSoffit™

B. Contact: Nicole Garrard; NMGarrard@armstrong.com; (662) 460-5587

2.02 ACOUSTICAL CEILING UNITS

A. Acoustical Panels
   1. Surface Texture: Fine
   2. Composition: Mineral Fiber
   3. Custom Colors: Available in all colors tones
   4. Size: 48 in x 72 in x 7/8 in - Item #2604
   5. Edge Profile: Tapered edges four sides
   6. Noise Reduction Coefficient (NRC): ASTM C 423; Panel 0.80 (UL)
   7. Ceiling Attenuation Class (CAC): ASTM C 1414; Panel 46 (UL), System up to 48
   8. Sabin: Cloud Applications: 0.80 Sabins/SF & 1.33 Sabins/SF with infill item 8200T10
   9. Flame Spread: ASTM E 1264; Class A
   10. Light Reflectance (LR) White Panel: ASTM E 1477; 0.87
   11. Dimensional Stability: HumiGuard Plus
   12. Recycle Content: Post-Consumer and Pre-Consumer – up to 75%

B. Finish:
   1. Joint Compound
      a. Setting Compound: Lightweight setting-type drywall joint compound, Ultra lightweight drying-type drywall joint compound
      b. Joint Tape: Self-Adhesive mesh drywall joint tape (Panel to Panel)
         1) Use Setting Type Compound for initial coats and use Drying Type Compound for final coats per the installation instructions. DO NOT use any other type of drywall compound such as All-Purpose Compound.
         2) Paper tape at the wall intersections.
   2. Spray Applied Finish – Required Product: #2605WH or 2605BL Fine Texture Finish for AcoustiBuilt panels – White as manufactured by Armstrong World Industries.

C. Suspension Systems
   1. Armstrong Drywall Suspension Systems all main beams and cross tees shall be commercial quality hot-dipped galvanized steel
      a. Main beam: manufactured main beam- 1-1/2" knurled face with ScrewStop™ reverse hem by 1-11/16 inches high. Drywall Main Beams are factory punched with cross tee routs, hanger wire holes, and SuperLock™ main beam clip for a strong secure connection and fast accurate alignment. Drywall Main Beams are Heavy-duty performance per ASTM C635
      b. HD8906 - 12ft HD Drywall Main Beam 1-1/2 in
   2. Cross Tees: manufactured cross tee- 1-1/2" knurled face with ScrewStop™ reverse hem by 1-1/2 inches high with factory punched cross tee routs and hanger wire holes and XL stake on clip for a strong secure connection.
      a. XL8945P - 4ft Drywall Cross Tee
   3. Wall Molding:
      a. KAM12 - 12ft Knurled Angle Molding 1-1/4" Face
   4. Hanger wire: a Class 1 zinc coating, soft temper, pre-stretched, with a yield stress load of at least time three times the design load, but not less than 12-gauge.
   5. Fasteners (for Panel attachment)
      a. #6 x 1-5/8” Fine thread drywall screws
      b. Recommended Adhesives: Loctite PL Premium Polyurethane Construction Adhesive, OSI F38 Drywall Panel Adhesive.
   6. Perimeter Systems
      a. Commercial quality extruded aluminum alloy 6063 trim channel, factory finished in baked polyester paint. Commercial quality galvanized steel unfinished T-bar connection clips; galvanized steel splice plates.
         1) Color: White

b. Size: 120 in X 4 in (also available in 6”)
c. Recycle Content: Post-Consumer - 50% Pre-Consumer - 0%
d. Acceptable Product: AXIOM One Piece for Drywall, 4in Straight – AX1PC4STR or Curved AX1PC4CUR as manufactured by Armstrong World Industries

7. Axiom Trim Channel:
   a. AX4STR 4in Axiom Classic Straight
   b. AX1PC4STR 4IN One –Piece Drywall Trim
8. Axiom Bottom Trim with taping flange
   a. AXBTASTR – Bottom Trim for AcoustiBuilt (also available in curved)
9. Axiom Accessories:
   a. AXSPLICE - Splice Plate

D. CastWorks Access Panels for AcoustiBuilt
1. Surface Texture: Standard unfinished, paint grade. Can be coated to achieve any desired color.
2. Composition: Glass Fiber Reinforced Gypsum (GFRG/GRG)
3. Colors: Paint Grade (CPG)
4. Door Type: Lay-in
5. Door Shape: Squared Corners, Rounded Corners
6. Door Size: 9 in x 9 in, 12 in x 12 in, 16 in x 16 in, 18 in x 18 in, 24 in x 24 in, 22 in x 30 in (gasketed), 30 in x 30 in, 30 in x 30 in (gasketed)
7. Frame Thickness: 7/8 in (for AcoustiBuilt panels)
8. Design:
   a. Squared Corners Lay-in 7/8" frame thickness:AS0300S02T7G0CPG, AS0300S04T7G0CPG, AS0300S05T7G0CPG
   b. Rounded Corners Lay-in 7/8" frame thickness: AS0300R02T7G0CPG, AS0300R04T7G0CPG, AS0300R05T7G0CPG

2.03 PERFORMANCE REQUIREMENTS:

A. Design to support imposed loads of indicated elements without eccentric loading of supports. Where supported elements may induce rotation of ceiling system components, provide stabilizing reinforcement.

B. Acoustical Units Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50 as applicable to panel products, when tested in accordance with ASTM E84.

C. System Noise Reduction Coefficient (NRC): As applicable to acoustical units specified below, minimum, measured in accordance with ASTM C423.

D. Acoustical Unit Light Reflectance Coefficient: As applicable to acoustical units specified below.

2.04 FABRICATION

A. Shop fabricate system components to accommodate mechanical and electrical items.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that field measurements are as indicated on shop drawings.

D. Start of installation constitutes acceptance of project conditions.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.

B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

C. Install after major above-ceiling work is complete.

D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. Follow manufacturer installation instructions. Armstrong AcoustiBuilt Assembly and Installation Instructions (BPLA-299099) Click to follow to AcoustiBuilt Installation Instructions
   1. Control joints are required following the standards used for gypsum board listed in ASTM C840, Section 20
      a. Ceilings with perimeter relief cannot exceed 50 LF and 2500 SF between control joints
      b. Ceilings without perimeter relief cannot exceed 30 LF and 900 SF between control joints
   2. Panel joints and fasteners are finished with tape and compound to create a flat surface. While the materials used to finish AcoustiBuilt panels are also used to finish drywall, the procedure has unique requirements.
   3. Joint compound coverage shall be limited to preserve the acoustical performance of the panels. Compound at panel joints shall not exceed 8 inch widths. Compound applied to field fasteners shall not exceed 2 inch by 2-inch areas. All compound shall be smooth and free of tool marks and ridges. Panels are to be finished with taping knives. Production tools, including boxes, are detailed on the installation instructions.
   4. Sanding and inspection: Throughout the sanding process, inspect the surface frequently for flatness. Direct a light across the ceiling to highlight unevenness that requires attention.
   5. Fine Texture Finish shall be applied in 4-5 coat process (additional coat may be used to achieve the desired finish) as called out in the installation instructions. Fine Texture Finish for AcoustiBuilt is applied in multiple coats, layered to achieve a uniform appearance and acoustical performance. It is strongly encouraged to practice spraying to ensure proper calibration and technique are achieved. Refer to the installation video.
      a. AcoustiBuilt fine texture finish MUST be sprayed with a Graco Mark V texture system. This equipment properly atomizes the finish for acoustics and aesthetics. Fine texture finish is not intended for use with any other airless paint systems not recommended by Armstrong or to be applied by brush or rolling.
      b. See Manufactures installation instructions for correct spray tip, pressure settings for spray system, finish preparation, spray calibration and spray procedure and technique.

3.04 TOLERANCES

A. Maximum Variation From Flat Plane: 1/8 inch in 10 feet, non-cumulative.

B. Maximum Offset From True Alignment or Position: 1/8 inch.

3.05 ADJUSTING

A. Remove sags or twists in ceiling system assembly.

B. Replace damaged or faulty components.

3.06 CLEANING

A. Clean system components after adjustment and balancing of system has been completed.

END OF SECTION

SECTION 09 6423
WOOD PARQUET FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood parquet flooring, adhesive applied.

B. Surface finishing.

1.02 RELATED REQUIREMENTS

A. Section 09 6429 - Wood Strip and Plank Flooring.

B. Section 09 9300 - Staining and Transparent Finishing

1.03 REFERENCE STANDARDS

A. MFMA (SPEC) - Guide Specifications for Maple Flooring Systems; current edition.

B. NWFA (IG) - Installation Guidelines; current edition located at www.nwfa.org.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring and floor finish materials.

C. Shop Drawings: Indicate floor joint pattern and termination details.

D. Samples: Submit two samples, minimum 12 by 12 inch in size illustrating floor pattern, floor finish, color, and sheen.

E. Installation Instructions: Indicate standard. Include manufacturer's recommendations for accessory products.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, suggested schedule for cleaning, stripping and re-finishing procedures, stain removal methods, and polishes and waxes.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 10 square yards matching installed flooring.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with MFMA (SPEC) and NWFA (IG).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

1.06 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

B. Provide heat, light, and ventilation prior to installation.

C. Store materials in area of installation for minimum period of 24 hours prior to installation.

D. Maintain minimum room temperature of 65 degrees F and relative humidity in accordance with adhesive manufacturer's instructions for a minimum period of 48 hours prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wood Parquet Flooring:
   1. Species: White oak.
   2. Grade: Clear.
   3. Cut: Quarter sawn.
   4. Moisture Content: 7 to 9 percent.
   5. Actual Thickness: 3/4 inch.
   6. Unit Size: As shown on Drawings.
   7. Edging: Tongue and groove, end matched.
   8. Pattern/Design: Grain matched edges and ends.

2.02 ACCESSORIES

A. Primers and Adhesives: Water-resistant; types recommended by flooring manufacturer for project substrates.

B. Transition Strip: Same species and finish as flooring material; profiles indicated.

C. Floor Finish: Specified in Section 09 9123.

D. Floor Finish: Polyurethane, to achieve high gloss surface; type recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive wood flooring.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

C. Verify that wood sub-floors have 12 percent maximum moisture content.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare sub-floor to receive wood flooring in accordance with manufacturer's, MFMA, and NWFA instructions.

B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

E. Apply primer to _____ surfaces.

3.03 INSTALLATION

A. Adhesives:
   1. Spread only enough adhesive to permit installation of materials before initial set. Exceeding adhesive manufacturer's recommended spread rate of adhesive for substrate is prohibited.
   2. Remove excess adhesive extruded through floor surface as work progresses.

B. Wood Flooring:
   1. Install wood flooring in accordance with manufacturer's, MFMA, and NWFA installation instructions.
   2. Set wood flooring in place, press with heavy roller to attain full adhesion.
   3. Lay flooring in patterns indicated on drawings. Verify alignment as work progresses.
   4. Arrange flooring with end matched grain set flush and tight.
   5. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.

6. Install flooring tight to floor access covers.
7. Provide 1/2 inch expansion space at fixed walls and other interruptions.

C. Finishing:
1. Mask off adjacent surfaces before beginning sanding.
2. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
3. Apply finish in accordance with floor finish manufacturer's and MFMA instructions.
4. Apply filler and three finish coats.
5. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
6. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
7. Apply last coat of finish.

D. Floor Access Covers: Install floor access covers specified in Section _____ in accordance with cover manufacturer's installation instructions.

3.04 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damaging surfaces.

B. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

3.06 SCHEDULES - SEE DRAWINGS

END OF SECTION

SECTION 09 6429
WOOD STRIP AND PLANK FLOORING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Wood strip and plank flooring, nailed.

B. Secondary subflooring.

C. Sleepers.

D. Sheet vapor retarder.

1.02 RELATED REQUIREMENTS

A. Section 09 0160 - Wood Flooring Restoration; new wood strip flooring to match adjacent original flooring to be refinished as part of this Section.

B. Section 09 9300 - Staining and Transparent Finishing

1.03 REFERENCE STANDARDS

A. NWFA (IG) - Installation Guidelines; current edition located at www.nwfa.org.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for flooring and floor finish materials.

C. Shop Drawings: Indicate floor joint pattern, termination details, indicate provisions for expansion and contraction.

D. Samples: Submit two samples, full specified width and minimum 12-inches long, illustrating floor finish, color, and sheen.

E. Installation Instructions: Indicate standard and special installation procedures.

F. Maintenance Data: Include maintenance procedures and recommended maintenance materials.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 10 square yards matching installed flooring.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with NWFA (IG).

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install wood flooring until wet construction work is complete and ambient air at installation space has moisture content stabilized at maximum moisture content of 40 percent.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain minimum room temperature of 65 degrees F for a period of two days prior to delivery of materials to installation space, during installation, and after installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Wood Strip Flooring:
   1. Species: White oak.
   2. Grade: Clear.

3. Cut: Quarter sawn.
4. Moisture Content: 7 to 9 percent.
5. Actual Thickness: 3/4 inch.
6. Actual Width: 2-1/4 inches.
7. Edge: Tongue and groove.
8. End: Square.
9. Lengths: Random, minimum of 9 inches.

B. Flooring Nails: Type recommended by flooring manufacturer.

C. Sleepers and Shims: Softwood lumber, pressure treated for moisture protection, 2 by 4 inch size.

D. Secondary Subflooring: 1 inch thick plywood, APA Rated Sheathing, span rating of 48/24,C-C Plugged Exterior in accord with PS 1-95. with square edges; Exposure 1.

E. Vapor Retarder: Black polyethylene sheet, 8 mil thick; 2 inch wide tape for joint sealing.

F. Sheathing Paper: Plain building paper.

2.02 ACCESSORIES

A. Transition Strip: Same species and finish as flooring material; profiles indicated.

B. Floor Finish: Polyurethane, to achieve surface matching adjacent restored existing wood finish; type recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that concrete subfloor surface is smooth and flat to plus or minus 1/4 inch in 10 feet.

C. Verify wood subfloor is properly secured, smooth and flat to plus or minus 1/4 inch in 10 feet.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Sleepers and Shims:
1. Place vapor retarder over subfloor surface, lapping edges and ends minimum 6 inches and tape seal; spot glue in place.
2. Place sleepers over vapor retarder; space sleepers at 16 inches on center.
3. Shim underside of sleepers to achieve level line of plus or minus 1/4 inch in 10 feet.
4. Anchor sleepers to concrete substrate with explosive driven concrete nails; place nails at 22 inches on center.

B. Secondary Subflooring: Place plywood subflooring over sleepers.
1. Lay perpendicular to the sleepers, with end joints over sleepers, and nail at 12 inches on center. Leave 3/8" gap for expansion at edge of flooring. Leave 3/32" gaps for expansion between subflooring panels.

C. Prepare substrate to receive wood flooring in accordance with manufacturer's and NWFA instructions.

D. Broom clean substrate.

3.03 INSTALLATION

A. Sheathing Paper: Place over wood subfloor; lap edges and ends 2 inches, staple in place.

B. Wood Flooring:
1. Install in accordance with manufacturer's and NWFA instructions; predrill and blind nail to subfloor.
2. Lay flooring parallel to length of room areas. Verify alignment as work progresses.
3. Arrange flooring with square ends set flush and tight.

4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar; provide divider strips and transition strips in accordance with flooring manufacturer's recommendations and as indicated.
5. Install edge strips at unprotected or exposed edges, and where flooring terminates.
6. Secure edge strips before installation of flooring with stainless steel screws.
7. Install flooring tight to floor access covers.
8. Provide 3/8" inch expansion space at fixed walls and other interruptions.

C. Install base at floor perimeter to cover expansion space in accordance with manufacturer's instructions. Miter inside and outside corners.

D. Finishing:
1. Comply with requirements in Section 09 9300 - Staining and Transparent Finishing.
2. Mask off adjacent surfaces before beginning sanding.
3. Sand flooring to smooth even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.
4. Apply finish in accordance with floor finish manufacturer's instructions.
5. Apply filler and stain and three finish coats.
   a. Apply first coat, allow to dry, then buff lightly with steel wool to remove irregularities. Vacuum clean and wipe with damp cloth before applying succeeding coat.
   b. Lightly buff between coats with steel wool and vacuum clean before applying succeeding coat.
   c. Apply last coat of finish.

E. Floor Access Covers: Install floor access covers specified in other Sections in accordance with cover manufacturer's installation instructions.

3.04 CLEANING

A. Clean and polish floor surfaces in accordance with floor finish manufacturer's instructions.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Place protective coverings over finished floors; do not remove coverings until Date of Substantial Completion.

3.06 SCHEDULES - SEE DRAWINGS

END OF SECTION

SECTION 09 6623
RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Epoxy matrix terrazzo with ground and polished finish.

B. Divider strips and recessed mat frames.

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

D. NTMA (EPOXY) - Epoxy Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc.; Current Edition located at www.ntma.com.

E. NTMA (GRAD) - Aggregate Gradation Standards; The National Terrazzo and Mosaic Association, Inc.; current edition.

F. NTMA (SPECS) - Terrazzo Specifications; The National Terrazzo and Mosaic Association, Inc.; current edition located at www.ntma.com.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips, control joint strips, expansion joints, and sealer; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. For precast units, detail profile and anchorage requirements. Show layout of the following:
   1. Divider strips.
   2. Control-joint strips.
   3. Accessory strips.
   4. Terrazzo patters
   5. Terrazzo Cove Base.

D. Samples: Submit two samples for each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in size indicated below:
   1. Terrazzo: 6-inch square Samples.
   2. Accessories: 6-inch-long Samples of each exposed strip item required.

E. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

F. Cleaning and Maintenance Data: [endif]Include manufacturer s instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Qualification Data: For installer and manufacturer.

1. Installer: provide proof of NTMA membership, documentation of experience, and resumes of key personnel.
2. Manufacturer: Provide proof of NTMA membership and written approval of installer.

C. [endif]Installer Certificates: Signed by manufacturer certifying that installers comply with manufacturer s requirements.

D. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

E. Source Limitations for Aggregates: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

F. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

1.05 MOCK-UP

A. Construct loose mock-up of terrazzo illustrating appearance of finished work in each configuration required. Size mock-up to be not less than 3 by 3 feet. Pallet mockup to show color transitions and joint detailing.

B. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store terrazzo materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

C. Maintain minimum temperature of 60 degrees F.

D. Keep products away from fire or open flame.

1.07 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F or above 90 degrees F.

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

C. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

D. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

E. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1.08 WARRANTY

A. Labor and Material Warranty: Submit a written warranty, signed by both Installer and Manufacturer for resinous matrix terrazzo flooring for a period of one year from date of substantial completion. The warranty includes loss of bond and damage due to normal wear and tear.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Resinous Matrix Terrazzo Flooring: Key Resin; Key Epoxy Terrazzo System: www.keyresin.com/#sle.

B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:
   1. David Allen Company: www.davidallen.com/
   2. Terroxy Resin Systems: www.tmsupply.com/terroxy-resinous-flooring/
   3. Substitutions: See Section -01 2500 Substitution Procedures.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.

B. Floors:
   1. Thickness: 3/8 inch, nominal.
   2. Color(s):
      a. TRZ-01:
         1) Matrix: Custom.
         2) Filler: Custom.
         3) Aggregate(s): Custom up to 4 colors.
   3. Aggregate Type: Marble chips.
   4. Aggregate Size: No. 2, 1, and 0 in proportion shown in specified Plate.

2.03 MATERIALS

A. Flexible Reinforcing Membrane: Manufacturer s resinous membrane for substrate crack preparation and reflective crack reduction.

B. Reinforcement: Fiberglass scrim.

C. Primer: Manufacturer's product recommended for substrate and use indicated.

D. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
   1. Physical Properties without Aggregates:
      a. Hardness: 60 to 85 per ASTM D 2240, Shore D.
      b. Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
      c. Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
      d. Chemical Resistance: No deleterious effects by contaminants listed below after seven-day immersion at room temperature per ASTM D1308.
         1) Distilled water.
         2) Mineral water.
         3) Isopropanol.
         4) Ethanol.
         5) 0.025 percent detergent solution.
         6) 1.0 percent soap solution.
         7) 10 percent sodium hydroxide.
         8) 10 percent hydrochloric acid.
         9) 30 percent sulfuric acid.
         10) 5 percent acetic acid.
   2. Physical Properties with Aggregates: For resin blended with marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
      a. Flammability: Self-extinguishing, maximum extent of burning 1/4 inch per ASTM D 635.
      b. Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.

E. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
   1. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
   2. 24-Hour Absorption Rate: Less than 0.75percent.
   3. Dust Content: Less than 1.0 percent by weight.

F. Finishing Grout: Resin based.

2.04 ACCESSORIES

A. Divider Strips: L-type angle, 3/8" deep.
   1. Material: Brass.
   2. Top Width: 1/8 inch and 1/4" inch.

B. Control-Joint Strips: Separate, double L-type angles, positioned back-to-back, that match material and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated.

D. Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use.

E. Epoxy Based Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

F. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

G. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

H. Sealer: Colorless, non-yellowing, penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
   1. Products:
      a. 3M Stone Floor Protection System.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of materials to sub-floor surfaces.

C. Verify that concrete sub-floor surfaces are ready for terrazzo installation by testing for moisture vapor emission, internal relative humidity, and alkalinity; obtain instructions if test results are not within the following limits:
   1. Moisture Vapor Emission: Not greater than 3 lb per 1000 sq ft per 24 hours, tested according to ASTM F1869.
   2. Internal Relative Humidity: Maximum of 75 percent, tested according to ASTM F2170.
   3. Alkalinity: pH range of 5 to 9, tested according to ASTM F710.

D. Verify that required floor-mounted utilities are in correct location.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of foreign matter. Including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:
   1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup. Grinding of concrete substrates will not be acceptable.
b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations including but not limited to crack suppression, crack repair and leveling.
c. Use an epoxy based patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer s written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufcturer's written instructions.
1. Moisture Testing: Perform tests indicated below.
a. In-Situ Probe test: Perform relative-humidity test using in-situ probes per ASTM F2170. Proceed with installation only after substrates have a maximum 80 percent relative-humidity-level measurement.
b. Test Method: Test for moisture content recommended in writing by terrazzo manufacturer. Proceed with installation only after substrates pass testing.

D. Protect other work from water and dust generated by griding operations.

E. Epoxy Flattening Fill:
1. [endif]Mix two components and aggregate according to manufacturer s written instructions.
2. Apply membrane material by method acceptable to manufacturer.
3. Allow to cure for amount of time recommended by manufacturer.

F. Moisture Mitigation Membrane:
1. Mix two components and water according to manufacturer's written instructions.
2. Apply membrane material by method acceptable to manufacturer.
3. Apply evenly with no puddles to uniform thickness required by manufacturer. Multiple coats may be necessary for porous surfaces.
4. Allow to cure for amount of time recommended by manufacturer.
5. Provide as a Full Coverage Treatment at all terrazzo floor area.

G. Crack Reduction Material:
1. [endif]Mix two components according to manufacturer s written instructions.
2. Pour mixed material onto substrate and spread to uniform thickness required by manufacturer.
3. Apply more material to areas showing greater penetration and soaking into the substrate.
4. Allow to cure for amount of time recommended by manufacturer.

3.03 INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to namufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."

C. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

D. Form 12 inch wide border with divider strips at Lobby.

E. Place terrazzo mix over substrate to thickness indicated.

F. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

G. Flexible Reinforcing Membrane:
1. Prepare and prefill substrate cracks with rigid epoxy.
2. Install membrane at substrate cracks in areas to receive terrazzo.
3. Reinforce membrane with fiberglass scrim.

4. Prepare membrane according to manufacturer's written instructions before applying substrate primer.

H. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

I. Strip Materials:
   1. Divider and Control-Joint Strips:
      a. Locate divider strips in locations indicated.
      b. Install control-joint strips back-toback directly above concrete-slab control joints.
      c. Install control-joint
      d. Install strips in adhesive setting bed without voids below strips.

3.04 CURING

A. Cure terrazzo topping by sheet polyethylene curing method.

B. Close area to allow undisturbed curing.

3.05 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Rough Grinding: Grind with 24 or finer grit stones or with comparable diamonds plates. Follow initial griding with 80 or finer grit stones.

C. Fine Grinding: Grind with 120 or finer grit stones until all grount is removed from surface. Repeat rough griding, grout coat, and fine griding if large voids exist after initial griding. Produce surface with a minimum of 70 percent aggregate exposure.

D. Final Gridnding: Grind to 1000 grit finish.

E. Hand grind vertical and curved surfaces similarly.

3.06 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet.

3.07 CLEANING

A. Cleaning:
   1. Remove griding dust from installation and adjacent areas.
   2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry throughly.

B. Sealing:
   1. Seal surfaces according to NTMA's written recommendations.
   2. Apply sealer according to 3M Stone Floor Protection System's written instructions.

3.08 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

B. Protection: Ramboard and Plastic.

END OF SECTION

SECTION 09 6700
FLUID-APPLIED FLOORING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base with integral color patterns.

B. Divider Strips and accessories.

1.02 REFERENCE STANDARDS

A. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two samples, 4 by 4 inch in size illustrating color and pattern for each floor material for each color specified.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years documented experience. Must be self preformed by product manufacturer.

B. Applicator Qualifications: Company specializing in performing the work of this section.
   1. Minimum five years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.06 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F.

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fluid-Applied Flooring:
   1. Basis of Design: Desco; Quartz Cremona: www.descocoating.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FLUID-APPLIED FLOORING SYSTEMS

A. Epxoy Flooring Type EPX-01: Epoxy, two component, thermosetting, colored with mineral filler, with aggregate embedded in base coat.
   1. Base Coat: 1/8 inch thick; color as selected.

2. Aggregate: Small quartz chips, multiple colors as selected.
3. Top Coat: Epoxy, single component, thermosetting; 1/8 inch thick; clear.
4. Integral Cove Base: Provide 4" high turned up coved base with 1" radius cove as indicated on drawings. Use zinc J-trim at top cap.
5. Minimum Performance Characteristics:
   a. Compressive Strength (ASTM C-579) 10,200 psi
   b. Tensile Strength (ASTM C-307) 1,650 psi
   c. Flexural Strength 4,000 psi
   d. Shore D Hardness (ASTM D-2240) 85-90
   e. Bond Strength (ASTM D-4541) 425 psi
   f. Abrasion Resistance (ASTM D-460) 0.08 mg
   g. Pot Life 35 min
   h. Cure Time @ 77˚ F 10-12 hours
6. Epoxy top coats shall produce no color shift after exposure to fluorescent lighting on the “b” axis yellow index after 3 weeks exposure.

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
Betadyne	

7. Textures: Slip-resistance texture will be used by aluminum oxide mixture. Sample or mockup as designated should be provided for slip-resistance approval.
   a. Kitchen Area: Provide 180 grit.
8. Mildew Resistance: No growth.
9. UV Resistance: Ultra U.V. Resitant.
10. Color: Selected by Architect.
11. Basis of Design Product: Desco Quartz Cremona TG.

2.03 ACCESSORIES

A. Base Caps & Flooring Trim: Zinc with projecting base of 1/8 inch; color as selected.

B. Cant Strips: Molded of flooring resin material.

C. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.

D. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Internal Relative Humidity: ASTM F2170.
   2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

C. Apply primer or concrete slab moisture humitidy sealer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

A. Install cant strips at base of walls where flooring is to be extended up wall as base.

B. Install terminating cap strip at top of base and at door thresholds; attach securely to substrate.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.
   1. Desco Quartz Cremona TG is a hand troweled grade 11 Desco quartz aggregate. The system should be hand troweled to 1/4” thickness. BROADCAST FLOORS ARE NOT ACCEPTABLE.

B. Apply each coat to minimum thickness indicated.

C. Finish to smooth level surface.

D. Install raised water dam bump around perimetes of showers.

E. Cove at vertical surfaces.

F. Install integral cove base to height of 4" with 1" radius cove.
   1. Trowel apply vertical cove base and flat floor.
   2. Hand sand cove base.
   3. Apply three coats of resin to assure a smooth surface and cove.
   4. Do not allow resin to puddle in cove.

G. Seal perimeter of base cap against wall surface.

3.05 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

SECTION 09 6816
CARPETING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Broadloom carpet and carpet tiles, .

1.02 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

B. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

C. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

D. CRI (GL) - Green Label Testing Program - Certified Products; Carpet and Rug Institute; Current Edition.

E. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate seaming plan, method of joining seams, direction of carpet pile and pattern, location of edge moldings and edge bindings, layout of flat wire system.

D. Samples: Submit two samples 24 by 24 inch in size illustrating color and pattern for each carpet and cushion material specified.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional requirements.
   2. Extra Carpet: 5 percent (minimum 50 sq ft) of each type, color, and pattern installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.05 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

PART 2 PRODUCTS

2.01 BROADLOOM CARPET

A. Carpet, Type CPT-03: ASTM E648, Class I.
   1. Manufacturer: Innovative Carpets.
   2. Product: H550 Handtufted Rug.
   3. Design: Custom, to be determined by architect.
   4. Fiber Content: 100% NZ Wool.

5. Pile Texture: Cut or Loop.
6. Yarn Count: 1/82's.
7. Rows per inch: 6
8. Stitches per inch: 7
9. Carpet Pile Height: 0.433 inches.
10. Total carpet Thickness: 0.520 inch.
11. Weight: 88 oz/ sq yd.
12. Primary Backing: Cotton Canvas.
13. Secondary Backing: Scrim, Latex.
14. Yarn Treament: Mothproof.
15. Finish: Carved / uncarved.
16. Location: Stair Runner.

2.02 CARPET TILE

A. Available Products: Manufacture and product noted are indicative of style, pattern and quality required. Subject to compliance with requirements, Contractor to submit a comparable product by this or another manufacturer meeting the requirements noted.

B. Carpet Type, CPT-01:
   1. Provide allowance for material cost of $45 per sq yd. This does not include dealer mark-up, installation materials, or labor.
   2. Provide cushion underlayment where CPT-01 is located.
      a. Basis of Design: Shaw Contract, CushionWorx.

C. Carpet Type, CPT-02:
   1. Provide allowance for material cost of $25 per sq yd. This does not include dealer mark-up, installation materials, or labor.
   2. Provide cushion underlayment where CPT-02 is located.
      a. Basis of Design: Shaw Contract, CushionWorx.

D. Performance Characteristics:
   1. Flammability: Passes DOC-FF-1-70 Pill Test.
   2. Flooring Radiant Panel Test: Meets NFPA Class 1 when tested under ASTM E-648 glue down.

E. Warranties: Manufacturers Limited 25- year Wear Warranty.

2.03 ACCESSORIES

A. Subfloor Filler: Type recommended by carpet manufacturer.

B. Moldings, Transitions and Edge Strips: Metal, stainless steel or anodized aluminum.
   1. Product: Schluter Systems: Schiene, Deco or Reno profiles.

C. Adhesives - General: Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI Green Label certified; in lieu of labeled product, independent test report showing compliance is acceptable.

D. Seam Adhesive: Recommended by manufacturer.

E. Contact Adhesive: Compatible with carpet material ; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesives to subfloor surfaces. Any suface contaminate must be removed prior to installation of new flooring surfcaes.

C. Cementitious Sub-floor Surfaces: Verify that substrates have fully cured and ready for flooring installation by testing for moisture, alkalinity (pH) and compression strength.
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
   3. Verify cementitous sub-floor and any fillers have reached minimum 3000 psi strength.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove existing carpet and carpet cushion.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Vacuum clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots. Blend carpets from differnent cartons as necessary to ensure minimal variation.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

C. Contractor is required to vaccuum over trim seals with appropriate carpet scissors at carpet tile and trim all fibers that have bloomed or frayed.

END OF SECTION

SECTION 09 7200
WALL COVERINGS

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Surface preparation and prime painting.

B. Wall covering and borders.

C. Specialty wallcoverings including dry-erase and digitally printed vinyl.

1.02 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes; 2002 (Reapproved 2013).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Wall Covering Materials: 30 linear feet (or min. 5%) of each color and pattern of wall covering; store where directed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Vinyl Wall Covering - Type VWC-01: Fabric-backed vinyl roll stock.
   1. Comply with ASTM F793/F793M, Category V, Type II. Class A Fire Rating.
   2. Composition: Non-woven wallcovering
   3. Dimensions:Panoramic of 204 cm x 300 cm = 6.12 m² (8 0.31" x 118 .11" = 65.8 8 sq. ft.)
   4. Repeat: The pattern is repeatable, allowing several panoramics to be joined together.
   5. Color: Bister 59642.
   6. Manufacturers:
      a. Arte Internation; Sherwood: www.arte-international.com/
   7. Contact: Betsy Pollard; bpollard@koroseal.com; (901) 201-9359

C. Vinyl Wall Covering - Type VWC-02: Fabric-backed vinyl roll stock.
   1. Comply with ASTM F793/F793M, Category V, Type II. Class A Fire Rating.
   2. Composition: Non-woven wallcovering.
   3. Dimension: Rolls of 8.50 m x 0.70 m = 6 m² (9.30 yds x 27.56" = 64 sq. ft.)
   4. Pattern Repeat: Free Match.
   5. Color: To be selected by architects from manufacturers full line.
   6. Manufacturers:
      a. Arte Internation; Brushed Suede: www.arte-international.com/
   7. Contact: Betsy Pollard; bpollard@koroseal.com; (901) 201-9359

D. Vinyl Wall Covering - Type VWC-03: Fabric-backed vinyl roll stock.
   1. Comply with ASTM F793/F793M, Category V, Type II. Class A Fire Rating.
   2. Backing: Osnaburg.
   3. Weight: 20 oz.
   4. Width: 54".
   5. Pattern Repeat: Straight Random.
   6. Color: Portree.
   7. Manufacturer:
      a. MDC Wall; Genon Contract - European Linen: www.mdcwall.com

E. Wall Covering - Type WC-01:
   1. “Class A” for ASTM Designation E84-15a. Comparable to UL 723, ANSI/NFPA No. 255 & UBC No. 8-1.0
   2. Material: Matte Non-Woven.
   3. Roll Dimensions: 24 inch by 33 feet.
   4. Pattern Match: Straight.
   5. Pattern Repeat: 37.6 inches.
   6. Manufacturer:
      a. Milton and King; Woodland Birds Wallpaper: www.miltonandking.com.

F. Wall Covering - Types WC-02.
   1. Roll Width: 0.52 m.
   2. Roll Length: 10 m.
   3. Pattern Repeat: 53.3 cm.
   4. Pattern Match: Half Drop.
   5. Color: Multi, Old Olive on Duck Egg
   6. Manufacturers:
      a. Cole & Son; Hummingbirds 100/14069; www.cole-and-son.com

G. Specialty Wallcovering: Type SWC-01.
   1. Provide material allowance of $30 per square foot. This does not include dealer mark-up, installation materials, or labor.

H. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

I. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.

J. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.

B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Finish surface of gypsum board to level as required by wallcovering manufacturer and per spec 09 2116. Wallcoverings may require Level 5 finish prior to installation.

C. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

D. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

E. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.

F. Marks: Seal with shellac those that may bleed through surface finishes.

G. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.

H. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Horizontal seams are not acceptable.

F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

G. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

H. Cover spaces above and below windows, above doors, in pattern sequence from roll.

I. Where wall covering tucks into reveals, or metal wallboard or plaster stops, apply with contact adhesive within 6 inches of wall covering termination. Ensure full contact bond.

J. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 09 7413
MICROPERF MICROPERFORATED WOOD WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Microperforated wood wall panels.

B. Accessories for wall installation.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data sheet and installation instructions for each type of wall panel required.

B. Shop Drawings: Submit shop drawings, including details, for all walls. Coordinate wall layout, installation, and components with construction elements that penetrate walls or are supported by them. Show overall layout with dimensions and details for penetrations and intersections with other materials or building components.

C. Samples: Submit three (3) full size samples of each panel type and veneer type required.

D. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.

E. Test Reports: Upon request, submit certified test reports from recognized test laboratories.

F. Extra Materials:
   1. Deliver no less than two percent (2%) of each type, color and pattern of material.
   2. Extra materials shall be from the same production run as the original materials.
   3. Extra materials shall remain in the manufacturer's original packaging and given to the building owner upon substantial completion of the work. Store extra materials per instructions as described in storage and handling requirements.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers: Provide microperforated wood wall panels from a single manufacturer.
   2. Installers: Utilize an installer having demonstrated experience on projects of comparable size and complexity.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Storage and Handling Requirements:
   1. Handle products carefully to avoid damage or chipping edges.
   2. Store products in a clean, cool, dry place, and out of direct sunlight.
   3. Store products in a space where the ambient temperature and humidity conditions are being maintained at the levels indicated for the project when occupied for its intended use.

1.05 SITE CONDITIONS

A. Ambient Conditions:
   1. Permit panels to reach room temperature, 50 to 86 degrees Fahrenheit. Stabilize moisture content, 25 to 55 percent RH, for at least 72 hours before installation per AWI standards.
   2. Maintain ambient temperature and humidity conditions at levels indicated for the project when occupied for its intended use.
   3. Do not install products under environmental conditions outside manufacturer's recommended limits.

B. Existing Conditions: Do not install wood wall panels until space is enclosed and weather proofed, wet work is completely dry, and work on walls is complete.

1.06 WARRANTY

A. Provide manufacturer's written product warranty per Section 01 77 00 – Closeout Procedures.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ASI Architectural, 123 Columbia Court N, Chaska, MN 55318.
Phone: 888-258-4637. Fax: 952-448-2613. Website: www.asiarchitectural.com

2.02 DESCRIPTION

A. Wood Paneling, Type B: Microperf microperforated wood wall panels as manufactured by ASI Architectural.

B. Product Options:
   1. Panel Composition: Wood veneer.
   2. Core: Mineral Wool.
   3. Edge Banding: To match veneer species and finish.
   4. Finish: Custom stain to match architect sample with clear lacquer topcoat.
   5. Veneer Species: Custom to match architect sample (Grade AA, White Oak, Select, Plain Slice, Book Match).
   6. Perforation Size: 0.5mm.
   7. Perforation Pattern: Offset.
   8. Panel Size: Custom up to 60” x 144”; Refer to drawings.
   9. Panel Thickness: 3/4”.

C. Attachment hardware for wall panels as specified by manufacturer for installation.

D. Accessories with Options: Select one (1) option from the choices for each of the following accessories.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Inspect installation area and conditions under which work is to be performed for compliance with all manufacturers’ environmental requirements.
   2. All wet work in the installation area must be complete, cured, and dry prior to installation.
   3. Wall assembly shall be complete, inspected, and accepted before wall work begins.

3.02 INSTALLATION

A. Comply with manufacturer’s instructions and recommendations for installation of wall panels and industry standards.

B. Coordinate the exact size, location, and sequencing of penetrations of wall panels by all building components.

C. Lay out wall pattern per approved shop drawings if required. Where not otherwise indicated, lay out panels so margins on opposite sides of rooms are equal or greater than half (1/2) the panel width.

3.03 ADJUSTING

A. Adjust panels after installation so that surfaces are aligned, flush, and level with gaps between units consistent in width and straight.

3.04 CLEANING

A. Clean surfaces of wall panels per manufacturer’s instructions.

B. Remove and replace damaged or discolored material and material that cannot be properly cleaned.

C. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the owner.

END OF SECTION

SECTION 09 7700
FIBERGLASS REINFORCED WALL PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
   1. PVC trim.

1.02 RELATED SECTIONS

A. Section 09 2116 - Gypsum Board Assemblies.

B. Section 09 6700 - Fluid Applied Flooring.

C. Section 09 2601 - Corner Guards.

1.03 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)
   1. Izod Impact Strengths (ft #/in)
   2. Water Absorption (%)
   3. Tensile Strengths (psi) & Tensile Modulus (psi)
   4. Flexural Strengths (psi) & Flexural Modulus (psi)
   5. ASTM D 2583- Barcol Hardness
   6. ASTM D 5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   7. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.

C. Selection Samples: Submit manufacturer’s standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
   1. Submit complete with specified applied finish.
   2. For selected patterns show complete pattern repeat.
   3. Exposed Molding and Trim: Provide samples of each type, finish, and color.

E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site (available as downloads for most Marlite’s products at http://www.marlite.com/tech-details.aspx or by contacting Marlite at info@marlite.com).

1.05 QUALITY ASSURANCE

A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
   1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
      a. Wall Required Rating – Class A.

B. Sanitary Standards: System components and finishes to comply with:

1. United States Department of Agriculture (USDA) / Food Safety & Inspection Services (FSIS) requirements for food preparation facilities, incidental contact.
2. Food and Drug Administration (FDA) 2013 Food Code 6-101.11.
3. Canadian Food Inspection Agency (CFIA) requirements.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials factory packaged on strong pallets.

B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60 to 75°F) for 48 hours prior to installation.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work

B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
   1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.08 WARRANTY

A. Furnish one-year guarantee against defects in material and workmanship.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Marlite; 1 Marlite Drive, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com www.marlite.com.

B. Product:
   1. Standard FRP

2.02 PANELS

A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
   1. Dimensions:
      a. Thickness – 0.090 “ (2.29mm) nominal
      b. Width - 4'-0” (1.22m) nominal
      c. Length – 8’-0” (2.4m) nominal
   2. Tolerance:
      a. Length and Width: +/-1/8 “ (3.175mm)
      b. Square - Not to exceed 1/8 “ for 8 foot panels.

B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
   1. Flexural Strength - 1.7 x 104 psi per ASTM D 790.
   2. Flexural Modulus – 6.0 x 105 psi per ASTM D 790.
   3. Tensile Strength – 8.0 x 103 psi per ASTM D 638.
   4. Tensile Modulus – 9.43 x 105 psi per ASTM D 638.
   5. Water Absorption - 0.17% per ASTM D 570.
   6. Barcol Hardness (scratch resistance) of 30 as per ASTM D 2583.
   7. Izod Impact Strength of 7.0 feet lbs./in ASTM D 256

C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.

D. Class A (I) Fire-rated.

E. Texture: Pebble or Smooth.

F. Color: To be selected from manufacturers full line.

G. Finish: To be selected.

2.03 MOLDINGS

A. PVC Trim: Thin-wall semi-rigid extruded PVC.
   1. M 350 Inside Corner, 8’ length
   2. M 365 Division, 8’ length
   3. M 370 Edge, 8’ length
   4. Color: Light Grey

B. Outside Corner Guard:
   1. Refer to Section 10 2601 - Corner Guards.

2.04 ACCESSORIES

A. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
   1. Marlite C-551 FRP Adhesive - Water- resistant, non-flammable adhesive.
   2. Marlite C-915 Construction Adhesive - Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
   3. Titebond Advanced Polymer Panel Adhesive – VOC compliant, non-flammable, environmentally safe adhesive.

C. Sealant:
   1. Marlite Brand MS-250 Clear Silicone Sealant.
   2. Marlite Brand MS-251 White Silicone Sealant.
   3. Marlite Brand - Color Match Sealant.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
   1. Verify that stud spacing does not exceed 24” (61cm) on-center.

B. Repair defects prior to installation.
   1. Level wall surfaces to panel manufacturer’s requirements. Remove protrusions and fill indentations.

3.02 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence.

B. Cut sheets to meet supports allowing 1/8” (0.12 inch) clearance for every 8 foot of panel.
   1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
   2. Pre-drill fastener holes 1/8” (3mm) oversize with high speed drill bit.
      a. Space at 8” (200mm) maximum on center at perimeter, approximately 1” from panel edge.
      b. Space at in field in rows 16’ (40.64cm) on center, with fasteners spaced at 12” (1 feet) maximum on center.

C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
   1. Install panels with manufacturer's recommended gap for panel field and corner joints.
      a. Adhesive trowel and application method to conform to adhesive manufacturer’s recommendations.
      b. Drive fasteners for snug fit. Do not over-tighten.

D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.

1. All moldings must provide for a minimum 1/8 “(3mm) of panel expansion at joints and edges, to insure proper installation.
2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

3.03 CLEANING

A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.

B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

END OF SECTION

SECTION 09 8430
SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests; 2005 (Reapproved 2012).

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Manufacturers:
   1. Habitat Matter; Mogu Kana: www.habitatmatter.com/.
   2. Contact: Iris Riedel; iris.riedel@habitatmatter.com; (971) 277-1250.

B. General:
   1. Acoustic Wall Panel, Type AWP-01: Wall panel made of bio-based materials.
      a. Flammability (ASTM E 84): Panel components shall have Class A rating per ASTM E 84.
      b. Panel Core: Hemp composition.

c. Noise Reduction Coefficient (NRC): 0.90 for 3/4 inch thick panel when tested in accordance with ASTM C423 for mounting as listed below, per ASTM E795.
d. Mounting Method: Concealed Z-Clip with 3/4" air-gap. See drawings.
e. Pattern: Smooth Flat Panel.
f. Color: To be selected by architects from manufacturer's full range.
g. Panel Size: Custom. See drawings.
h. Edges: Micro Beveled.

2.02 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

B. Fixing Clips: Manufacturers standard for application as indicated.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

C. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
1. Plumb and level.
2. Flatness.
3. Width of joints.

3.02 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.03 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL V.23

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels, ledge angles, and exterior primed or unfinished metals.
   2. Mechanical and Electrical:
      a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Floors, unless specifically indicated.
   8. Ceramic and other types of tiles.
   9. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Exterior insulation and finish system (EIFS).
   11. Glass.
   12. Concealed pipes, ducts, and conduits.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

E. SSPC-SP 1 - Solvent Cleaning; 2015.

F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

G. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five (5) years experience.

C. Provide field testing for adhesion per ASTM D4551 for paint applied to steel and galvanized steel surfaces in locations directed by Architect, quantity of 2 locations.

1.05 MOCK-UP

A. Locate where directed by Architect.

B. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.08 WARRANTY

A. See section 01 7800 for CLOSEOUT SUBMITTALS, for additoinal warranty requirements.

B. Manufacturers Requirements: Provide standard manufacturers warranty.

C. Installers Requirements: Provide guarentee that surface cleaning and preparation has been performed as specified and that product(s) specified have been used at specified application. Provide 5 year warranty for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. Base Manufacturer: Sherwin Williams.
   2. Behr Process Corporation: www.behr.com/#sle.
   3. PPG Paints: www.ppgpaints.com/#sle.
   4. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As indicated in Color Schedule.
   1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer, all side of wood surfaces.
   2. On backside of concealed wood trim: One coat of latex primer sealer.
   3. Semi-gloss: Two coats of latex enamel.

B. Paint CE-OP-3L - Masonry/Concrete, Opaque, Latex, 3 Coat:
   1. One coat of block filler. Sherwin Williams Loxon Block Surfacer A24W200, coordinate requirements with coating manufacturer.
   2. Concrete and Masonry Coatings per Section 09 9723.

C. Paint GE-OP-3L - Exterior Gypsum Board and Exterior Plaster, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer. Loxon Concrete & Masonry Primer Sealer, A24W8300
   2. Flat: Two coats of latex; A-100 Exterior Latex Flat, A6 Series.

D. Paint ME-OP-3A - Ferrous Metals, Unprimed, Acrylic, 3 Coat:
   1. One coat of acrylic primer. Sherwin Williams B66-310 Series
   2. Semi-gloss: Two coats of acrylic enamel; Sherwin Williams B66-650 Series.

E. Paint ME-OP-3B - Ferrous Metals, Unprimed, Acrylic, 2 Coat: Exposed Exterior Structural Steel
   1. Touch Up of manufacturer acrylic primer: As reccommended by Tnemec
   2. Semi-gloss: Two coats of HDP acrylic enamel; Tnemec Enduratone Series 1029.

F. Paint ME-OP-2A - Ferrous Metals, Primed, Acrylic, 2 Coat:
   1. Touch-up with rust-inhibitive primer recommended by top coat manufacturer.
   2. Semi-gloss: Two coats of acrylic enamel; Sherwin Williams B66-650 Series.

G. Paint MgE-OP-3A - Galvanized Metals, Acrylic, 3 Coat:
   1. One coat galvanize primer.
   2. Semi-gloss: Two coats of acrylic enamel; Sherwin Williams B66-650 Series.

H. Paint MgE-OP-3X - Exterior Metal Handrails & Door Frames, Acrylic, 3 Coat:
   1. One coat ProCryl Universal Primer B66-310 Series.
   2. Semi-gloss: Two coats of DTM acrylic enamel; Sherwin Williams B66-200 Series.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Exterior Plaster and Stucco: 12 percent.
   2. Fiber Cement Siding: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

I. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

J. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

K. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

L. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

M. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.

C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Prime surfaces to receive wall coverings.
   3. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Glass.
   10. Concealed pipes, ducts, and conduits.

1.02 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2014.

C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

E. SSPC-SP 1 - Solvent Cleaning; 2015.

F. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

G. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.06 MOCK-UP

A. See Section 01 4000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 3 feet long by 3 feet wide, illustrating each paint color, texture, and finish.

C. Provide mock-up on-site of each accent paint colors selected by Architect, minimum 3 feet long by 3 feet wide, in location as directed by Architect. Accent colors to be reviewed by Architect for final approval PRIOR to accent painting starting. Proceeding with Accent painting without approval is done so at Contractor's own risk.

D. Provide door and frame assembly illustrating paint color, texture, and finish.

E. Locate where directed by Architect.

F. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
   1. Base Manufacturer: Sherwin Williams Company.
   2. Behr Process Corporation: www.behr.com/#sle.
   3. Pittsburgh Paints: www.ppgpaints.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Block Fillers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Colors: As indicated on drawings.
   1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
   2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:
   1. One coat of latex primer sealer. PrepRite ProBlock Latex Primer Sealer B51 Series
   2. Semi-gloss: Two coats of latex enamel; Pro Industrial Acrylic Semi Gloss B66-650 Series.

B. Paint MI-OP-3L - Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of acrylic primer. ProCryl Universal Primer B66-310 Series
   2. Semi-gloss: Two coats of acrylic enamel; Pro Industrial Semi-Gloss B66-650 Series.

C. Paint MI-OP-2A - Ferrous Metals, Primed, Acrylic, 2 Coat:
   1. Touch-up with recommended primer.
   2. Semi-gloss: Two coats of acrylic enamel; Pro Industrial Semi Gloss B66-650 Series.

D. Paint MI-OP-2L - Ferrous Metals / Roof Deck / Exposed Interior Structure, Primed, Latex, 2 Coat:
   1. Touch-up with recommended primer. Pro-Cryl B66-310 Series
   2. Semi-gloss: Two coats of water borne acrylic dryfall Pro Industrial Semi Gloss B42-80 Series. .

E. Paint CI-OP-3E - Concrete/Masonry, Epoxy Enamel, 3 Coat:
   1. One coat of catalyzed epoxy primer. Loxon Block Surfacer A24W200
   2. Gloss: Two coats of catalyzed epoxy enamel: Full Gloss. Pro Industrial Precatalyzed Gloss Epoxy B73-300 Series .

F. Paint GI-OP-3L - Gypsum Board/Plaster, Latex, 3 Coat:
   1. One coat of alkyd primer sealer. ProMar 200 Primer B28W2600 Series
   2. Semi-gloss: Two coats of latex enamel.
   3. Eggshell: Two coats of latex enamel; ProMar 200 B20-2600 Series.

4. Flat: Two coats of latex enamel; B30-2600 Series (ceilings).

G. Paint GI-OP-3M - Gypsum Board/Plaster, Epoxy Enamel, 3 Coat:
1. One coat of latex primer sealer. ProMar 200 Latex Primer B28W2600 Series
2. Gloss: Two coats of water based catalized epoxy enamel; Pro Industrial Epoxy B73-300 Series.

H. Paint FI-OP-3A - Fabrics/Insulation Jackets, Alkyd, 3 Coat:
1. One coat of alkyd primer sealer.
2. Eggshell: Two coats of alkyd enamel.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Gypsum Wallboard: 12 percent.
2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:
1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.

2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

F. Sand wood and metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9300
STAINING AND TRANSPARENT FINISHING

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of stains and transparent finishes.

1.02 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category.

C. Samples: Submit two samples, illustrating selected colors and sheens for each system with specified coats cascaded. Submit on actual wood substrate to be finished.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, safety data sheets (SDS), care and cleaning instructions, and touch-up procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of stain or transparent finish, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Stain and Transparent Finish Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by manufacturer of stains and transparent finishes.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperature: 50 degrees F unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Provide finishes from the same manufacturer to the greatest extent possible.

B. Transparent Finishes:
   1. Behr Process Corporation: www.behr.com/#sle.
   2. Pittsburgh Paints Deft Interior Clears/Polyurethanes: www.ppgpaints.com/#sle.
   3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Stains:
   1. Behr Process Corporation: www.behr.com/#sle.
   2. Pittsburgh Paints Deft Interior Stains: www.ppgpaints.com/#sle.
   3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

2.02 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:
   1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each finish material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide stains and transparent finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.

2.03 EXTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Ceilings:
   1. 2 coat(s) varnish over 2 coat(s) stain.
   2. Stain: Exterior Semi-Transparent Stain for Wood, Water Based; MPI #156.
      a. Products:
         1) Pittsburgh Paints ProLuxe Cetol SRD Semi-Transparent Matte Wood Finish, SIK500-190. (MPI #156)
         2) Sherwin-Williams WoodScapes Polyurethane Semi-Transparent Stain.
         3) Substitutions: Section 01 6000 - Product Requirements.
   3. Top Coat(s): Exterior Clear Water Based Varnish with UV Inhibitor.
      a. Products:

1) Pittsburgh Paints Deft Interior/Exterior Water Based Polyurethane, Flat, DFT 258.
2) Substitutions: Section 01 6000 - Product Requirements.

2.04 INTERIOR STAIN AND TRANSPARENT FINISH SYSTEMS

A. Finish on Wood - Vertical Surfaces: Refer to 06 4100 Architectural Wood Millwork.
1. 2 coat(s) varnish over 2 coat(s) stain, or as required by manufacturer instructions.
2. Stain: Semi-Transparent Stain for Wood, Water Based; MPI #186.
a. Products:
1) Pittsburgh Paints Deft Interior Water-Based Wood Stain, DFT300 Series. (MPI #186)
2) Sherwin-Williams MinWax 250 VOC Oil Wood Stain.
3) Substitutions: Section 01 6000 - Product Requirements.
3. Top Coat(s): Polyurethane, Catalyzed.
a. Products:
1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Urethane, Flat.
2) Substitutions: Section 01 6000 - Product Requirements.

B. Finish on Wood - Floors.
1. 2 coat(s) varnish over 2 coat(s) stain or as required by manufacturer's instructions.
2. Stain: Semi-Transparent Stain for Wood; MPI #90.
a. Products:
1) Pittsburgh Paints Deft Interior Oil-Based Fast Dry Stain, DFT570 Series. (MPI #90)
2) Pittsburgh Paints Deft Interior Oil-Based Wood Stain, DFT400 Series. (MPI #90)
3) Sherwin-Williams MinWax 250 VOC Oil Stain. (MPI #90)
4) Substitutions: Section 01 6000 - Product Requirements.
3. Top Coat(s): Polyurethane Varnish, High Build.
a. Products:
1) Sherwin-Williams MinWax High Build Polyurethane, Gloss.
2) Substitutions: Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of finished surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of stains and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Sand wood surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

G. Reinstall items removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 10 2601
WALL & CORNER GUARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking for wall and corner guard anchors.

B. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

C. Section 09 7700 - Fiberglass Reinforced Wall Panels.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010.

C. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2014.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

F. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

1.06 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Provide five year manufacturer and installer warranty for metal crash rails.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall and Corner Guards:

1. Construction Specialties, Inc: www.c-sgroup.com.
2. Inpro; Basis of Design: www.inprocorp.com.
3. Pawling Corp: www.pawling.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

C. Fungal Resistance: Unless otherwise noted, provide protection products and assemblies which pass ASTM G21 testing.

2.03 PRODUCT TYPES

A. Corner Guards (CG-01): Stainless steel corner guard, type 304 alloy with #4 satin finish .
   1. Manufacturer: Inpro: www.inprocorp.com.
      a. Model SS Corner Guard 90° stainless steel corner guard with 1/8" radius and 2" standard legs. Bull nose 3/4" (19.1mm) radius. Mounted with stainless steel screws.
      b. Product Number: SAS-1828H-430.
   2. Nose Radius: 1/8 inch
   3. Resistant to certain bacterial & fungal growth per ASTM G 2276 and ASTM G 2196
   4. Chemical resistant per ASTM D 543
   5. Impact resistant per ASTM F 47684
   6. UL Class A/1 fire rated and labeled
   7. California 01350 Testing VOC Emissions
   8. Height: 8 feet.

B. Corner Guard (CG-02): Surface mount stainless steel end wall protector.
   1. Manufacturer: Inpro: www.inprocorp.com.
   2. Leg: 2 inches
   3. Corner Radius: 1/8 inch
   4. Thickness: 0.080 inches
   5. Height: 96 inches.
   6. Material: Stainless Steel, type 430, 16 gauge stainless.
   7. Attachment: Screw-on.
   8. Finish: Stainless steel, No. 4 sating finish.

C. Adhesives and Primers: As recommended by manufacturer.

D. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

E. See Section 06 1000 for wood blocking for wall and corner guard anchors.

F. See Section 09 2116 for supports in stud wall construction.

2.04 FABRICATION

A. Fabricate components with tight joints, corners and seams.

B. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position protective wall covering no less than 2 inch above finished floor to allow for floor level variation.
   1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.
   2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.
   3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.
   4. Use a roller to ensure maximum contact with adhesive.
   5. At inside and outside corners cut covering sheets to facilitate installation of trim pieces or corner guards.

3.03 CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

1.02 REFERENCE STANDARDS

A. ASTM A666/A666M - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2024.

B. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004 (Reapproved 2010).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Adhesive: Two component epoxy type, waterproof.

C. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

D. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

E. Contractor to provide blocking at all wall-mounted toilet accessories.

2.02 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser **(TA-1)**: Surface-mounted toilet paper dispenser with shelf, holds two rolls.
   1. Product: 5B2-110089-BN Elvari™ Toilet Paper Dispenser with Shelf by Bradley Corp.

B. Toilet Paper Dispenser **(TA-1a)**: Surface-mounted jumbo roll toilet paper dispenser. Cabinet holds one roll (up to 10" diameter) of 1-1/2", 2-1⁄8" or 3" diameter core toilet tissue.
   1. Products: 5B2-113600-BN Elvari® Jumbo Roll Toilet Paper Dispenser by Bradley Corp.

C. Paper Towel Dispenser **(TA-2)**: Surface-mounted towel dispenser. 20-gauge, 300 series stainless steel in electrocoat finishes. Towel dispenser holds C-fold or multi-fold towels, approximately 400 folded paper towels.
   1. Product: 2B1-113400-BN Elvari™ Surface-Mounted Towel Dispensers by Bradley Corp.

D. Electrical Hand Dryer: Touch free capacitive sensor activation, 12 second hand dry time measurement, 79 dB sound power level, low or high voltage.
   1. Products: Dyson Airblade V.

E. Waste Receptacle **(TA-4)**: Free-standing waste receptacle, 20 gauge, 300 series stainless steel in electrocoat finish. Welded, pill-shape construction with hemmed edges on top and bottom. Bag retention ring holds disposable liners in place.
   1. Minimum Capacity: 21 gallons.
   2. Product: 3B1-113800 Elvari® Free-Standing Waste Receptacle with Cover by Bradley Corp.

F. Soap Dispenser **(TA-5)**: Liquid soap dispenser, free-standing on vanity.
   1. Products: Mercer Polished Nickel Soap Dispenser by Pottery Barn.

G. Soap Dispenser **(TA-6)**: Surface-mounted soap dispenser shall be fabricated of 20-gauge, 300 series stainless steel in electrocoat finishes. Dispenser shall have completely concealed mounting and low-level indicator.
   1. Minimum Capacity: 40 ounces.
   2. Products: 6B1-1100000-BN Elvari™ Manual Surface-Mounted Soap Dispenser by Bradley Corp.

H. Grab Bars **(TA-7)**: Oval grab bar shall be fabricated of 18-gauge, 300 series stainless steel in a electrocoat finish with welded end caps.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Length and Configuration: As indicated on drawings.
      c. Products: 8B1 Series Elvari Grab Bars x Length required, by Bradley Corp.

I. Baby Changing Station **(TA-8)**: Recessed, wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285. Exposed surfaces are 304 stainless steel, satin finish.
   1. Product: #9013 by ASI.

J. Coat / Robe Hook **(TA-9)**: Surface-mounted hook shall be fabricated of 14-gauge, 300 series stainless steel in a brushed #3 satin finish or optional electrocoat finishes. Fasteners, set screws, and hex key included.
   1. Product: 9B1-110000-BN Elvari™ Coat/Robe Hook by Bradley Corp.

K. Framed Mirror: **(TA-10)**: Frame mirror shall be high quality 1/4" flat glass, guaranteed for 15 years against silver spoilage. Radiused corners and edges ground and polished smooth. Vertical mounting only. Frame mirrors feature 20-gauge stainless steel frame in electrocoat finishes.
   1. Size: 24 x 36 inches.
   2. Product: 7B1-0024360-BN Elvari Frame Mirror by Bradley Corp.

L. Countertop Waste Chute Ring **(TA-11)**: Stainless steel, countertop mounted circular form, 10 inch diameter opening, 3 inches deep.
   1. Product: TM10B 10" Dia x 3" Deep Stainless Steel Trash Grommet by Mocket.
   2. Finish: To be selected.

2.03 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder **(MBH-1)**: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Provide one at each mop sink, typical.
   2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.
   5. Products: B239 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL V.22

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

D. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Amerex: www.amerex-fire.com.
   2. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
   3. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
   4. Potter-Roemer: www.potterroemer.com/#sle.
   5. Strike First Corporation of America: ABC-Seamless Steel Fire Extinguisher; www.strikefirstusa.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. BASIS OF DESIGN: AActivar Construction Products Group - JL Industries; Cavalier Series: www.activarcpg.com/#sle.
   2. Larsen's Manufacturing Co; Medallion Series: www.larsensmfg.com.
   3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.
   2. Provide bi-lingual labels.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. UL-rated 4-A:80-B:C
   2. Stored Pressure Operated: Deep Drawn.
   3. Class: A:B:C type.
   4. Size: 10 pound.
   5. Finish: Baked polyester powder coat, color as selected.
   6. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.
   1. Typical Unless Noted Otherwise: Formed steel; 0.036 inch thick base metal.

C. Fire Rated Cabinet Construction: One-hour fire rated. For installation in fire-rated partitions.

D. Cabinet Configuration: Semi-recessed type, coordinate with wall cavity depth.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with 1-1/2 inch wide face.
   3. Projection: 1-1/2" to 2-1/2".

E. Door: Solid (no glazing) 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with continuous piano hinge.

F. Handle Type: Match pull.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

H. Finish of Cabinet Exterior Trim and Door: Brass.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

C. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Coordinate size of cabinets to ensure that the type and capacity of appliances and accessories indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

D. Verify rough openings for cabinet are correctly sized and located.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions per NFPA and ADA standards.

B. Install cabinets plumb and level in wall openings, 24 inches from finished floor to inside bottom of cabinet. Mounting height as required by Authorities Having Jurisdiction for ADA Accessibility Guidelines from finished floor to the carrying handle.

C. Secure rigidly in place.

D. Place extinguishers in cabinets, unless otherwise indicated.

E. Position cabinet signage at wall, directly above cabinet and lettering on cabnet doors after painting is complete.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices and alarms operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.04 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

END OF SECTION

SECTION 10 5100
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal storage lockers.

B. Solid plastic lockers.

1.02 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Finish Samples: Submit two samples 3 by 6 inches in size, of each color selected.

D. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Storage Lockers:
   1. Global Industrial: Durham HD Cabinet; www.globalindustrial.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Solid Plastic Lockers:
   1. Columbia Lockers, a division of PSiSC; PolyLife Lockers: www.psisc.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Metal Storage Locker: Cabinet with paired doors containing expanded metal mesh, and adjustable shelves.
   1. Width: 48 inches.
   2. Depth: 24 inches.
   3. Height: 72 inches
   4. Locking: Keyed locks; keyed alike.
   5. Integral Locker Base

B. Wardrobe Lockers: Single tier solid plastic (HDPE) wall mounted with matching closed base.
   1. Width: 15 inches.
   2. Depth: 15 inches.
   3. Height: 72 inches
   4. Fittings: Size and configuration as indicated on drawings.
      a. Hat shelf.
      b. Coat rod.
      c. Hooks: One single prong.
   5. Ventilation: By horizontal slots at the top and bottom of door.
   6. Locking: Latch capable of fitting personal padlock; lock not provided.
   7. Integral Locker Base
   8. Provide sloped top.

2.03 METAL STORAGE LOCKERS

A. Storage Cabinet: Factory assembled, made of formed sheet steel, powder-coated, stretcher leveled; fully welded, metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Color: Gray; Manufacturer's standard.

B. Capacity: 700 lbs.

C. Body: Formed and flanged; with steel stiffener ribs; all welded.
   1. Body and Shelves: 14 gage, 0.0747 inch.
   2. Back: 14 gage, 0.0747 inch.

D. Frames: Formed channel shape, welded and ground flush, welded to body.
   1. Door Frame: 14 gage, 0.0747 inch, minimum.

E. Doors: Single sheet w/ single bends top and bottom, double bends at sides.
   1. Door Outer Face: 14 gage, 0.0747 inch, minimum.
   2. Door Style: Pair doors with metal mesh for visibility and ventilation.

F. Shelves:
   1. Provide manufacturer's standard adjustable shelves, 1-inch increments.
   2. Number of adjustable shelves per cabinet: 3.

G. Hinges: Manufacturer's standard full piano hinge.

H. Integral Base: 14 gage, 0.0478 inch

I. Locks: Manufacturer's standard three-point locking system.
   1. Provide 2 keys for each cabinet.
   2. Provide matching keys for multiple cabinets.

2.04 SOLID PLASTIC LOCKERS

A. Lockers: Factory assembled, made of high density polyethylene (HDPE) panels, tested in accordance with NFPA 286, homogenous color throughout, with mortise and tenon joints with stainless steel fasteners or heat fused joints.
   1. Doors: Full overlay without frame.
   2. Where locker ends or sides are exposed, provide same finish as fronts or provide extra panels to match fronts.
   3. Ventilation: By horizontal slots at the top and bottom of door.
   4. Provide filler strips where indicated, securely attached to lockers.
   5. Door Color: To be selected by Architect from manufacturer's full range.
   6. Body Color: Manufacturer's standard white or light color.

B. Component Thicknesses:
   1. Doors: 1/2 inch minimum thickness.
   2. Locker Body: Tops, bottoms, backs, and shelves 3/8 inch minimum.
   3. End Panels and Filler Panels: 1/2 inch minimum thickness.
   4. Sloped Tops: 1/2 inch minimum thickness.
   5. Toe Kick Plates: 1/2 inch minimum thickness.

C. Solid Plastic Panels: High Density polyethylene (HDPE) formed under high pressure into solid plastic components.

D. Hinges: Full height of locker, manufacturer's standard heavy duty type.

E. Coat Hooks: Stainless steel; attached with tamperproof screws.

F. Latch: Locker manufacturer's standard type of style indicated above.

G. Locker Legs: ABS plastic adjustable support and leveling leg, minimum 1 inch adjustment; with hardware for attaching toe kick plates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

E. Install end panels.

F. Install accessories.

G. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

KITCHEN EQUIPMENT - SECTION 11 4000

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the contract, including general and supplementary conditions and general documents, apply to the work specified in this section.

1.2 SCOPE OF WORK

A. Include all labor, materials, and freight required to deliver, install, set in place, level, hang hood(s), erect walk in(s), run refrigeration line(s), etc. for the equipment specified in this section.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Recessed and raised floor areas including reinforced concrete wearing bed and specified floor material with coved corner bases inside walk-ins by Division 03 00 00.

B. Millwork not specified in this section is to be provided under Division 06 00 00.

C. Rough-in, final connection, indirect drains, drain traps, grease traps, steam traps, PVC for drink lines, strainers, water coolers, hand sinks, mop sinks, tailpieces, valves, stops, shut off valves, pipes, line strainers, atmospheric vents, pipe fittings, ventilators, duct work, exhaust and supply fans, disconnection and reconnection of existing equipment and all materials not specified in this section are to be provided and installed by Division 22 00 00 and Division 23 00 00.

D. Rough-in, final connection, lines, disconnect switches, safety cut off, fittings, outlets, convenience outlets, pull boxes, wiring, conduit, junction boxes, fuse boxes, control panels, starters, shunt trip breakers (required for the shut off of all electrical outlets under the ventilator and shut off of ventilator fan(s) in the event the fire suppression systems is activated), contactors, disposer and walk-in control wiring, inter connection of fire suppression system with building alarm, disconnection and reconnection of existing equipment and all materials not specified in this section are to be provided and installed by Division 26 00 00, Division 27 00 00 and Division 28 00 00.

1.4 FEES, LICENSES, INSPECTION, PERMITS AND TAXES

A. Pay all fees, licenses, inspections, permits and taxes required by state and local authorities for the equipment specified in this section and furnish receipts for same.

1.5 JURISDICTIONS, TRADE AGREEMENTS AND RESTRICTIONS

A. Portions of this work may be sub-contracted to those qualified to do such work as may be required because of jurisdictional trade agreements and restrictions.

1.6 QUALITY ASSURANCE

A. Submit evidence to the owner, architect and consultant of qualifications listed below:

1. Successful completion of projects of comparable size and scope.

2. Maintain a staff experienced in the installation of Kitchen Equipment and the preparation of professional drawings and brochures.

1.7 SUBSTITUTIONS

A. It is the purpose of these plans and specifications to purchase for the owner equipment that conform to the best existing policies of the commercial kitchen equipment Industry. These items have been selected as preferred items as a result of past experiences, functional design, construction, material, maintenance and repair. If a contractor elects to quote on substitutions not specified, they will be permitted to do so provided that they list these substitutions on a separate form (do not use alternates in the base bid unless pre approved) outlining them as additions or deductions to the specified brand. Any contractor offering a substitution shall accompany the bid with complete construction details, and specification sheets.

B. If a proposed substitution is accepted the kitchen equipment contractor shall provide and pay for all changes to, space, structure, utilities, construction, professional services, modify other items, provide rough in drawings, specifications, etc. that may be required.

1.8 INTERPRETATION OF DOCUMENT

A. The specifications and drawings are complementary and what is called for by one shall be binding as if called for by both. Contractors shall examine the full set plans and specifications to be fully satisfied as to the conditions of the project. No allowance shall be subsequently made to the contractor by reason of error on his part or obvious oversight not called to the attention of the Owner, Architect, General Contractor and Consultant.

B. Questions regarding specifications and drawings will be responded to by written addendum only.

1.9 WARRANTIES

A. Warranties for parts and labor in writing for all new Kitchen Equipment for a period of one year from date of acceptance.

B. Refrigeration system compressors shall be warranted for an additional four years by the manufacturer.

C. Provide at no cost to owner, refrigeration service including freon, mileage, parts and labor to all refrigeration equipment within 24 hours of notification for one year from date of acceptance.

1.10 REGULATIONS AND CODES

A. Comply with all applicable laws, statues, building codes, regulations of state, local, public authorities and comply with the following:

1. National Sanitation Foundation.
2. National Fire Protection Association.
3. Underwriter’s Laboratories, Inc.
4. Department of Energy’s 2017 Energy Efficiency Standards.
5. 2016 Paris Climate Agreement.
6. 2009 Federal Energy Saving Standards.

7. Factory Mutual.
8. Building Official and Code Administrators.
9. National Electrical Code.
10. American Gas Association Labs.
11. Occupational Safety and Health Act.
12. National Electrical Manufactures Association.
13. Americans with Disabilities Act.
14. American National Standards Institute.
15. American Society of Mechanical Engineers.

1.11 SUBMITTALS

A. Kitchen equipment contractor shall review rough-in drawings provided and notify the Architect, Consultant and Construction Manager or General Contractor in writing with in 15 days of any utility changes required for the equipment. Submit in thirty days dimensioned drawings showing all Kitchen Equipment items with itemized schedules, mechanical rough-in, electrical rough-in and critical conditions plan.

B. Submit in thirty days dimensioned drawings showing complete construction details of all fabricated equipment.

C. Submit in thirty days brochures of regularly manufactured items with project label, project cover sheet, item cover sheet, and specification sheet.

D. Submit number and type drawings as requested by the owner, architect, consultant and general contractor.

E. Submit in thirty days material samples with manufacturer’s name plate and item number for review to the Owner, Architect, Consultant and Construction Manager or General Contractor.

F. Submit prior to kitchen equipment demonstration operation/instruction manuals with item cover sheet (indicate on item cover sheet for the kitchen equipment, make, model number, serial number and local service agency with address and phone number for the project location) and copy of manufacturer’s operation and instruction manual.

G. Provide pictures of completed punch list deficiencies to Contractor, Architect Owner and Consultant for review after all punch list work has been completed.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver any Kitchen Equipment to the project until advised and building is weather and vandal safe.

1.13 JOB CONDITIONS

A. Before ordering Kitchen Equipment and starting work verify measurements at job site. Be responsible for fitting Kitchen Equipment into space provided. No extra charge or compensation will be allowed for minimal difference between dimensions indicated and actual field dimensions.

B. Verify that Kitchen Equipment will fit through openings provided.

C. Prior to ordering Kitchen Equipment verify all mechanical and electrical utilities available at the project site and coordinate.

1.14 SCHEDULING

A. Coordinate and schedule delivery and installation of Kitchen Equipment so as not to impede project construction schedule. Coordinate number of days required for equipment installation with owner and general contractor.

PART 2 – PRODUCT

2.1 MATERIALS

A. United States standard gauge 18-8, type 302, not over .012% maximum carbon stainless steel with a number 4 finish.

B. Armco Galvanized Steel.

2.2 MANUFACTURED EQUIPMENT

A. Standard finishes and accessories unless specifically deleted. Options shall be by same manufacturer.

B. Follow the manufactures installation instructions.

C. All equipment for high altitude operation, elevation approximately 7200 feet above sea level as required.

2.3 FABRICATION

A. General

1. Provide fabricated Kitchen Equipment as specified.
2. Fabricated by one manufacture with consistent construction for like items.
3. Grind all welds of stainless steel smooth and polish to a number 4 finish.
4. Use concealed type bolts to fasten trim to paneling and body of equipment, and secure to exposed sheet metal surface.
5. Use stainless steel bolts and screws.
6. Where threads of bolts and screws occur on inside of fixtures, are visible, or might come in contact with a wiping cloth, cover screw with washer and stainless steel acorn nut.
7. Do not use rivets to fasten body paneling together.

B. Sound deadening

1. Provide Schnee Butyl-Sealant ½” wide rope as a sound deadening material between all metal surfaces and tighten bolts for maximum compression of sealant.

C. Painting

1. Non-stainless steel finishes painted two coats of hammer tone gray, air-dried.
2. Oven baked finishes for 2 hours at a minimum temperature of 300º F.

D. Stainless Steel Tops

1. 14 gauge stainless steel tops with one piece fully welded construction. Free edges turned down 2” and back on slight angle ½” with corners fully welded, ½” high marine edge with fully welded corners or as detailed, indicated and specified.
2. Where tops fit adjacent to equipment, walls and columns cove up to specified height and back on 45º angle or as specified forming a back splash and Zee clip to wall, unexposed. Enclose ends of back splashes, extending full length of fixture including rolls.
3. Reinforce underside of tops with fully welded 14 gauge stainless steel angle and channel framework of suitable size and at locations as required to hold top flat and support heavy loads without deflection. Provide two hat channels to support drawer assemblies, enclosed bases and leg/gusset as required.
4. Provide cross members at 30” on centers maximum. No bolts or pop rivets in tops.

E. Field Joints

1. Fully weld grind smooth and polish to a number 4 finish. Field joints in bases pull tight and cover with pilaster of same material as base. Minimum field joints required for access into building.

F. Coved Corners

1. Vertical and horizontal corners coved on a ¾” radius and cove at intersections.

G. Enclosed Bases

1. 18 gauge stainless steel formed flat approximately 1” on bottom then formed up to the underside of the top then formed flat approximately 1” to the inside of the cabinet and formed down approximately ½” to create a rigid structure with all seams fully welded, ground smooth and polished. Front rails, mullions, and other components to provide appearance of one piece construction fully welded seamless with no open cracks or ledges.
2. 18 gauge stainless steel U channel filler behind mullions weld in place grind smooth and polish.

H. Legs & Cross rails

1. 1 5/8” outside diameter, 16 gauge stainless steel tubing, fully welded at cross rails, ground smooth, and polished.
2. Fit leg with adjustable stainless steel bullet or flange foot with holes secured to floor with non corrosive anchors.
3. Open base legs fit at top with stainless steel gusset welded 360 degrees to underbracing.

I. Under shelves

1. 18 gauge stainless steel shelves in enclosed bases, turn rear and ends up with a hug edge, fully weld corners grind smooth and polish. Flush shelf with base fully weld, grind smooth and polish.
2. 18 gauge stainless steel shelves in open based, free sides turn down 2" and back ½ ", at wall or tall equipment turn up 2" with corners notched and fully welded to legs, grind smooth and polish.

J. Casters

1. NSF, 5" diameter, polyurethane, all swivel, top operated foot brake, zerk grease fitting, and to support 300 pound load.

K. Drawers

1. Component Hardware S90-0020*M126 with four sided 14 gauge stainless steel frame fully welded corners, flange top in, and bolt to hat channels. S90-0015*M126 for smaller spaces.
2. Provide cylinder locks when specified in itemized specifications, all keyed alike.

L. Sinks and Drain boards

1. 14 gauge stainless steel fully welded construction with all corners coved on ¾" radius.
2. Double wall partitions between sink compartments.
3. Slope drain boards to sink compartment.
4. Crease bottom of sink for proper drainage.
5. Drain boards constructed integral with sink compartments.
6. Fisher 22411*M126 drain with 14 gauge stainless steel bracket.
7. T & S B-231*M126 faucet.

M. Over Shelves

1. 18 gauge stainless steel fully welded construction, form as specified for tops, provide stainless steel underbracing as required to support shelf without deflection turn up 2" at wall and equipment.
2. Table mounted shelves mounted on 1" tubing, 16 gauge stainless steel tubing fully welded to top or back splash.
3. Wall mount shelves on 14 gauge stainless steel brackets attached to wall with stainless steel screws.

2.4 SCHEDULE OF EQUIPMENT

A. For all new kitchen equipment Kitchen Equipment Contractor shall provide:

1. All items with standard features unless specifically modified or deleted.
2. Assembly and installation according to the manufacture's instructions.
3. Onsite supervision and coordination for all the Kitchen Equipment utility connections.

4. Startup, testing and calibration by the manufacture's authorized service agencies.
5. Onsite demonstration by the manufacture's representative.
6. All items shall have a one year onsite parts, service and labor warranty.
7. Five year compressor warranty for items with a refrigeration system.
8. Refrigerant(s) and refrigeration system(s) shall comply with all current local, state, national and federal government energy efficiency and energy saving standards.

A. Item 1, 1A, 1B and 2, 2A, 2B and 86, 87 and 88 - Walk in cooler, freezer, beer cooler and refrigeration systems – one lot required

1. Thermo-kool Industries.
2. Fabricated according to details, drawings and specifications.
3. Provide the following:

a. THE BUILDING RECESS OR FLOOR MUST BE LEVELED BY THE KITCHEN EQUIPMENT CONTRACTOR OR WALK IN INSTALLER WITH SELF LEVELING CONCRETE FAILURE TO PROPERLY LEVEL THE AREA WILL VOID THE WALK IN MANUFACTURERS WARRANTY.

b. SILICONE MAY NOT BE USED INSIDE THE WALK IN TO SEAL INTERNAL SEAMS.

c. After complete installation, (including electrical conduits, drains and refrigeration piping and all air tight sealing) prior to refrigeration system start up, Kitchen Equipment Contractor shall blower door test the walk in compartments for ambient air infiltration according to all standards and methods specified in the current ATTMA TSL2 (The Air Tightness Testing and Measuring Association TSL2) for non dwellings. Compartment(s) shall meet or exceed the air leakage standards between normal 0.35 and best practice 0.20 for walk ins (cold stores). Temporarily seal air tight drains, pressure relief ports, etc. Test seams, penetrations, etc. for air leaks with a hand held fog generator, mark any air leaks with non staining bright peel off tape, repair any air leaks found with the fog generator, this may require disassembly, resealing and reassembly. Retest for air leaks until none are detected during the fog test. Test administrator, methods, procedures, testing equipment, written reports and include copy of testing equipment printouts shall be provided according to ATTMA TSL2. Test administrator shall be factory trained, certified and licensed. Testing equipment shall be calibrated before testing. Door opening(s) larger than 34" x 76" will require the Kitchen Equipment Contractor to temporarily reduce the size of the opening with a enclosure that is compatible with the testing equipment and that can withstand the pressure generated during the test. One year onsite parts, service, labor and air leak warranty.

d. The walk ins shall be fully installed sixty days before final completion of the project to allow time for testing and refrigeration system start up.

e. Kitchen equipment contractor shall start up the refrigeration system(s) ten days before the end of the project and allow the system(s) to run until the project is turned over to the owner, any

condensation, water or ice forming inside the walk in may require disassembly, drying out, resealing airtight, reassembly and blower door testing.

f. Kitchen equipment contractor shall seal all floor, wall and ceiling panel seams and joints airtight with two (2) continuous 3/8" beads of Kason 3701 butyl sealant apply with a battery operated caulk gun. BUTYL SHALL BE UNEXPOSED, DO NOT APPLY BUTYL TO EXTERIOR.

g. KITCHEN EQUIPMENT CONTRACTOR SHALL KEEP WALK IN PENETRATIONS TO A MINIMUM.

h. Kitchen equipment contractor shall furnish and seal airtight all penetrations in the walk in panels for all trades with spray polyurethane insulating foam sealant (rigid or closed cell) the thickness of the panel without any voids, allow sealant to fully cure, trim excess and seal the exposed urethane foam on both sides of the panel watertight with silver NSF food grade 100% silicone sealant. KEC SHALL KEEP WALK IN PENETRATIONS TO A MINIMUM.

i. Kitchen equipment contractor shall furnish, install, coordinate size and location with the electrician NEMA 4 (non metallic) PVC electrical components, conduits, junction boxes, etc. for walk in panel electrical penetrations. Seal airtight around the outside of the conduit with spray polyurethane insulating foam sealant the thickness of the panel without any voids. Seal airtight inside of the conduit around the wires the thickness of the panel without any voids. KEC SHALL KEEP WALK IN PENETRATIONS TO A MINIMUM.

j. All electrical components inside the walk in shall be watertight.

k. Disconnects used inside the walk ins for evaporators fans and evaporator electric defrost heaters shall be NEMA 4 rated.

l. Kitchen Equipment Contractor shall furnish, install and seal airtight with spray polyurethane insulating foam sealant all penetrations required for the walk ins, KEC SHALL KEEP WALK IN PENETRATIONS TO A MINIMUM.

m. Kitchen equipment contractor shall provide a Thermo-kool Industries factory trained and certified person onsite to supervise the complete assembly and installation of the walk in system. Provide name of factory trained and certified person in submittal documents for verification.

n. Kitchen equipment contractor shall level the floor or recess provided for the walk in with self leveling concrete allow to fully cure according to manufactures instructions before installing walk in. SAND IS NOT ALLOWED FOR LEVELING.

o. NSF certified construction and components. Bear NFS seal.

p. Non standard size as required to fit the space. Wall and ceiling panels shall be built in 1" increments up to 46" wide. Corner panels shall be 90 degree angle, 12" x 12". All like panels shall be fully interchangeable. Field verify all measurements prior to release for fabrication.

q. 0.040 embossed aluminum exposed exterior.

r. 26 gauge stucco embossed galvanized unexposed, exterior.

s. 0.040 embossed aluminum interior.

t. Trim openings on sides (at walls) with matching exterior material angles neatly attached with stainless steel screws.

u. Trim openings on top (at free sides) with matching exterior material, lift off, removable, enclosure panels, attach trim with stainless steel screws.

v. 4” thick zero ozone depleting urethane insulation foamed in place and bonded to interior surfaces of panels. All panels R-32.

w. The perimeter frame of all panels shall be formed with a rigid structural high density urethane insulation forming tongues and grooves (soft edge foam panel construction is not allowed). Cam locks shall be formed into the perimeter frame for easy assembly and disassembly.

x. Panels shall be constructed without interior metal, straps or wood.

y. Insta-Loks cam locks, three per wall, maximum 43” on centers for taller walls. Insta-Loks cam locks in ceiling panels maximum 36” on centers.

z. 8’-6” high above building finished floor.

aa. Set in 4” deep recess in building floor.

bb. Beer cooler 7’-0” high above building finished floor, floorless. Verify and coordinated height.

cc. Exterior walk in walls shall be installed 2” off all building walls.

dd. Kitchen equipment contractor shall furnish and install below the walk in floor panels and up all sides of the recess 10 mil polyethylene sheeting with all seams sealed watertight with tape.

ee. Floor foamed in place 1/8” diamond thread aluminum floor with ¾” plywood and structural support.

ff. Beer cooler is floorless with walls sealed air tight in vinal screeds and vinal screeds sealed sir tight to the floor with two (2) continuous 3/8” beads of Kason 3701 butyl sealant apply with a battery operated caulk gun.

gg. Beer cooler 34” door, omit door glass panel. Secure door panel to floor with aluminum angle and stainless steel screws.

hh. 34” wide X 78” high doors with 14” x 24” view port and heated, triple pane safety glass, each door. Freezer 30” door.

ii. 14 gauge stainless steel thresholds, 45 degree angle at interior and exterior.

jj. Thermostatically controlled heated door jamb and threshold for cooler and freezer doors.

kk. Kason 1238C chrome polished latch (handle) with cylinder lock and interior glow in the dark twist off safety release, each door.

ll. Kason 1094 chrome polished hydraulic closer, each door.

mm. One Kason 1830, 120/1, heated pressure relief port in the wall between the cooler and freezer.

nn. One Kason 1830, 120/1, heated pressure relief port in the cooler door panel.

oo. Two Kason 1346 chrome polished performer adjustable spring loaded hinges, each door.

pp. Kason Thermalflex vinyl strip door curtains, each door.

qq. Flush mounted 4700HL multi monitor(s) with built in battery back up or equal, PC connect kit, flush mounted MD-1 motion detectors, flush mounted IP-1 illuminated push button panic switches and MC-1 magnetic door contacts pre wired into each door panel.

rr. Kason 1806 LED lights with frosted high impact lexan globe and LED bulbs centered over each door.

ss. Eiko VTS-5CS-40K-U (09712) 48” led light with 50,000 life hours, 120-277/1, 40 watts, 5200 lumen. Kitchen Equipment Contractor shall secure fixtures to the ceiling, unexposed, with stainless steel hardware. DO NOT PENETRATE EXTERIOR OF WALK IN CEILING PANELS TO INSTALL FIXTURES. Two in cooler and two in freezer.

tt. KE2 Therm Solutions evap OEM controllers with recessed basic displays for all evaporator coils. KE2 electronic expansion valves for all evaporator coils. 8 port switch. EM plus wireless router. Cat5e data cables. Set up to KE2 smart access program with computers and devices. Complete installation/set up and fully operational wireless remote temperature motoring system.

uu. Refrigerant(s) and refrigeration system(s) shall comply with all current local, state, national and federal government energy efficiency and energy saving standards.

vv. AL2 compliant R454A refrigerant for refrigeration systems.

ww. ¾ horse power (7,390 btu) and sized to maintain +35 degree temperature, pre wired preassembled remote cooler condensing unit, 208/1 with outside weatherproof cover, expansion valve, dryer, sight glass, temperature control, pump down solenoid valve, pressure control, suction line vibration eliminator, coil mounting kit, crankcase heater, headmaster valve, etc. Evaporator coil, 120/1. 105 degree ambient. KE2 Therm Solutions components and stands must be included with refrigeration systems.

xx. 2 1/2 horse power (7,465 btu) and sized to maintain -10 degree temperature, pre wired preassembled remote freezer condensing unit, 208/1 with outside weatherproof cover, expansion valve, dryer, sight glass, temperature control, pump down solenoid valve, freezer time clock (when required), pressure control, suction line vibration eliminator, coil mounting kit, crankcase heater, headmaster valve, etc.. Evaporator coil, 208/1, drain line heat tape. 105 degree ambient. KE2 Therm Solutions components and stands must be included with refrigeration systems.

yy. ¾ horse power (7,390 btu), Beer cooler, and sized to maintain +34 degree temperature, pre wired preassembled remote cooler condensing unit, 208/1 with outside weatherproof cover, expansion valve, dryer, sight glass, temperature control, pump down solenoid valve, pressure control, suction line vibration eliminator, coil mounting kit, crankcase heater, headmaster

valve, etc. Evaporator coil, 120/1. 105 degree ambient. KE2 Therm Solutions components and stands must be included with refrigeration systems. Evaporator coil ASLA25061ADA.

zz. Kitchen equipment contractor shall furnish and install copper refrigeration lines from evaporator coils to condenser properly sized for length of run, suction lines insulated with 1" UV rated arma flex, liquid lines insulated with ½" UV rated arma flex, seal all arma flex seams water tight. Seal all building penetrations for lines air tight with spray foam insulation.

aaa. Support refrigeration lines from structure and run refrigeration lines in chase(s) from condenser to evaporator coil.

bbb. 14 gauge removable U shaped stainless steel trim to cover refrigeration lines.

ccc. Refrigeration lines shall be wrapped with white Speedline or equal 0.020 mil. UV rated cut and curl PVC jacketing with SSL self seal lap with all seams sealed water tight with PVC liquid adhesive.

ddd. Refrigerant(s) and refrigeration system(s) shall comply with all current local, state, national and federal government energy efficiency and energy saving standards.

eee. Electrical contractor to furnish and install NEMA 4 electrical disconnect for the cooler and or freezer evaporator coil fans and in the freezer a NEMA 4 electrical disconnect for the evaporator coil defrost heater.

fff. Kitchen equipment contractor shall hang evaporator coils with nylon (only non metallic) all thread rod and stainless steel nuts and washers, seal penetrations air tight.

ggg. Raychem H622, 208/1 (H612, 120/1), wet location winter guard self regulating drain line heat tape(s) with connection kits and H912 gel fill end seal kits. One piece tape with no tees or splices. Heat tape of sufficient length and installed to prevent freezing of walk in drain pipes. Hard wire heat tape to evaporator coil.

hhh. Set condensers air intake side 36" minimum from walls, etc. and 36" minimum exhaust side from walls, etc. Set ends 36" minimum from other condensers, walls, etc. Do not set condensers in the exhaust path of any other heat generating equipment.

iii. Custom fabricated condenser stand and or wall mounting rack for each condensing unit, fully welded, 24" high, 14 gauge stainless steel top, 12 gauge stainless steel angle frame and legs, tabs with holes welded to bottom of each leg. Secure stand/rack legs with non corrosive anchors. Secure condenser to the stand/rack with stainless steel screws.

jjj. Roof and or curb mounted set units on four Adamax RTS14-10 or equal, 10" long, 650 pound capacity rubber blocks with galvanized uni strut. Secure condenser frame to block with galvanized anchors at all four corners. Provide a layer of Duro-last DL-40 vinyl 40 mil material between the roof and the blocks when blocks are set directly on the roof.

kkk. Roof curbs for refrigeration systems shall be furnished installed by the general contractor, roofer or other trades on site during building construction, coordinate size.

lll. Kitchen equipment contractor shall furnish and install 3/4" hard copper drain lines from evaporator coils to floor drain, slope 1/2" to 12" minimum, fully insulated with ¾" arma-flex

insulation, provide clean out tees with plugs and P traps to prevent the back flow of air into freezer from the cooler, or exterior, and from the kitchen into the cooler. Drain pipe to exit the walk in approximately 12” above finished floor, seal penetrations air tight.

mmm. Provide all components required for the complete and proper operation of the walk-in cooler and freezer for the location, region, climate, altitude, etc. of the installation.

nnn. 3/16” diamond thread aluminum kick plate 36” high on interior and exterior of each door.

ooo. 3/16” diamond thread aluminum kick plate 36” high on interior and exterior of the door panels, notch above floor base material as required.

ppp. 3/16” diamond thread aluminum kick plate 36” high at exposed exterior, stop kick plate 4” from building walls to allow space for installation of angle trim.

qqq. Beer cooler 3/16” diamond thread aluminum kick plate 36” high at all interior and exterior walls.

rrr. The walk in and refrigeration systems shall be set in the location shown on the kitchen plans. The kitchen equipment contractor will be required to disassemble, move and reinstall the walk-in and refrigeration systems if not set how and where shown.

sss. Internal and or external structure and all hardware required to support, fully assemble and install walk in the location shown on the plans.

ttt. Kitchen equipment contractor shall provide and seal air tight all penetrations in the walk in panels for all trades, verify and coordinate.

uuu. Kitchen equipment contractor shall fully insulate all fire sprinkler pipes as required to prevent condensation, water and ice and from forming on the pipe and dripping inside and or on to the exterior top of the walk in.

vvv. Kitchen equipment contractor shall furnish, install, coordinate size and location with the electrician of NEMA 4 PVC (only non metallic) electrical components for walk in panel electrical penetrations. Seal around the outside of the conduit airtight. Seal airtight inside of conduit around wires 4” thick from one side of the panel to the other.

www. KEC KEEP WALK IN PENETRATIONS TO A MINIMUM.

xxx. All electrical components inside the walk in shall be watertight.

yyy. Preassemble walk in at factory for a complete quality control inspection.

zzz. Kitchen equipment contractor personnel shall be onsite during all kitchen equipment ductwork, plumbing and electrical final connections.

B. Item 3 – Walk in shelving – four required

1. Metro metroseal 3, super erecta.
2. Provide the following:

a. Two units with four 18” x 48” wire shelves and four 63” high post, each unit.
b. One unit with four 18” x 60” wire shelves and four 63” high post.
c. One unit with five 18” x 72” wire shelves and four 74” high post.
d. Field verify space and adjust sizes to fit the space as required.
e. Assemble onsite verify and coordinate shelf spacing with owner.

C. Item 4 – Dry storage shelving – three required
1. Metro metroseal 3, super erecta.
2. Provide the following:
a. Two units with five 21” x 72” wire shelves and four 74” high post, each unit.
b. One unit with fiver 18” x 36” wire shelves and four 74” high post.
c. Field verify space and adjust sizes to fit the space as required.
d. Assemble onsite verify and coordinate shelf spacing with owner.

D. Item 5 – Air curtain – one required
1. Mars STD242-1U.
2. Provide the following:
a. 120/1.
b. Motor control panel.
c. Door limit switch.
d. Adjustable wall mounting brackets.
e. Grey color.

E. Item 6 – Bun pan rack – one required
1. Advance tabco PR203W, fully welded construction.

F. Item 7 – Table with sink – one required
1. Fabricated according to details, drawings and specifications.
2. Provide the following:
a. 14 gauge stainless steel one piece coved corner top.

b. Marine edge where shown 35 ½" to top.

c. 36" high to top of marine edge.

d. 8" high splash at walls from top of marine edge, 8 ½" high from top.

e. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls.

f. Two 14 gauge stainless steel hat channels full length, fully welded to end channels. DO NOT OMIT OR NOTCH CHANNELS FOR DRAWER FRAME.

g. Copper flashed weld studs capped with stainless steel acorn nuts.

h. ¾" tacky tape between all metal surfaces, installed to create a vermin proof seal.

i. Stainless steel gussets fully welded 360 degrees to channels.

j. 1 5/8" 16 gauge stainless steel tubing legs.

k. 1 5/8" 16 gauge stainless steel tubing crossrails fully welded 360 degrees to legs.

l. Stainless steel adjustable bullet feet.

m. Stainless steel flanged feet with two holes at four corners, secure to floor with two non corrosive anchors.

n. One 18" X 20" X 10" deep 14 gauge stainless steel coved corner sinks.

o. T & S B-0184-CR faucet.

p. Fisher 22411 lever handle drain(s) with 14 gauge stainless steel handle bracket secure to sink bottom with weld studs and stainless steel acorn nuts, hole in bracket 1/8" maximum larger (LARGE HOLE OR ELONGATED SLOT IS NOT ALLOWED) than handle diameter. MODIFIED drain handle length (reduce or extend) to make the drain handle flush with the face of the sink bowl.

q. 16 gauge stainless steel removable overshelf mounted on 1 5/8" outside diameter tubing supports through splash secured to brackets fully welded to legs, 2" X 3/16" stainless steel band fully weld to brackets full length and stainless steel double sided pot hooks 8" on centers. Mount 60" above finished floor (66" at pot sink/dishtable), verify height with owner. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls (rear).

r. Channels shall be welded to each other with a 1"x1" x 4" x 1"x 1" continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.

s. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

t. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.

u. Z clip splash to wall, unexposed.

G. Item 8 – Table – two required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:
   a. 14 gauge stainless steel coved corner top. 36” high to top.
   b. All free sides turned down 1 ½” and back ½” on a slight angle.
   c. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½” and back ½” on a slight angle and turn up 2” at walls.
   d. Copper flashed weld studs capped with stainless steel acorn nuts.
   e. Two 14 gauge stainless steel hat channels full length, fully welded to end channels. DO NOT OMIT OR NOTCH CHANNELS FOR DRAWER FRAME
   f. ¾” tacky tape between all metal surfaces, installed to create a vermin proof seal.
   g. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.
   h. Stainless steel gussets fully welded 360 degrees to channels.
   i. 1 5/8” 16 gauge stainless steel tubing legs.
   j. 5” diameter polyurethane casters all with brakes and 300 pound load capacity each.
   k. Channels shall be welded to each other with a 1”x1” x 4” x 1”x 1” continuous weld, typical. Gussets shall be welded to channel or plate with a 360 degrees continuous weld, typical.
   l. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

H. Item 9 – Refrigerator – one required
   1. Traulsen G10010 or equal by Continental.
   2. Provide the following:
      a. 120/1 with cord and plug.
      b. Seven pair universal angle slides with mounting hardware.
      c. Reach in refrigerators and freezers must be from the same manufacture.

I. Item 10 – Freezer – one required
   1. Traulsen G12010 or equal by Continental.
   2. Provide the following:
      a. 120/1 with cord and plug.
      b. Seven pair universal angle slides with mounting hardware.
      c. Reach in refrigerators and freezers must be from the same manufacture.

J. Item 11 – Soiled dishtable – one required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:
   a. 14 gauge stainless steel one piece coved corner top.
   b. 3” high with a 1½” diameter semi-roll at free sides.
   c. 18” high splash at walls. Reduce to 8” through pass thru opening.
   d. Notch splash for roll up door track, verify and coordinate.
   e. 14 gauge stainless steel fully welded channels, cap front.
   f. Copper flashed weld studs capped with stainless steel acorn nuts.
   g. ¾” tacky tape between all metal surfaces, installed to create a vermin proof seal.
   h. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½” and back ½” on a slight angle and turn up 2” at walls.
   i. 21” X 21” X 5” deep 14 gauge stainless steel coved corner pre-rinse sink with removable perforated 16 gauge stainless steel scrap basket and 1” round stainless steel tubing rack runners fully welded to basket.
   j. T & S B-0133-CR-B08C*M126 pre rinse faucet with ceramic cartridges and riser support secured to wall with stainless steel screws.
   k. Fisher 30376 basket drain.
   l. The Drain Strainer 1392 installed below sink.
   m. Stainless steel gussets fully welded 360 degrees to channels.
   n. 1 5/8” 16 gauge stainless steel tubing legs.
   o. 1 5/8” 16 gauge stainless steel tubing crossrails fully welded 360 degrees to legs.
   p. Stainless steel adjustable bullet feet.
   q. Stainless steel adjustable flanged feet with two holes at all front legs secure to floor with two non corrosive anchors.
   r. Z clip splash to walls, unexposed.
   s. Channels shall be welded to each other with a 1” x 1” x 4” x 1”x 1” continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.
   t. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.
   u. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

K. Item 12 – Scrap collector – one required

1. The Drain Strainer 1392. Note cost approximately $1,200.00.

L. Item 13 – Dishmachine, vent free - one required

1. Hobart AM-16VLT-BAS, CORNER.
2. Provide the following:
   a. 208/1
   b. Separate electrical connections.
   c. Rapid fill kit for hot water connection.
   d. Built in 70 degree rise booster heater.
   e. Drain water tempering kit factory installed.
   f. Electric tank heat.
   g. Tall tank.
   h. Splash shield for corner installations.
   i. Hobart rack for washing 18 x 26 bun pans.
   j. Two combination (flat) racks.
   k. Four peg racks.
   l. Brass pressure regulator valve, as required.
   m. Water hammer arrestor kit.

M. Item 14 – Clean dishtable with pot and pan sink– one required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:
   a. Pot sink is integral with the clean dishtable.
   b. 14 gauge stainless steel one piece coved corner top.
   c. 3” high with a 1½” diameter semi-roll at free sides.
   d. 18” high splash at walls.
   e. 14 gauge stainless steel fully welded channels, cap front.
   f. Copper flashed weld studs capped with stainless steel acorn nuts.
   g. ¾” tacky tape between all metal surfaces, installed to create a vermin proof seal.

h. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls.

i. Stainless steel gussets fully welded 360 degrees to channels.

j. 1 5/8" diameter 16 gauge stainless steel tubing legs.

k. 1 5/8" diameter 16 gauge stainless steel crossrails fully welded 360 degrees to legs.

l. Stainless steel adjustable bullet feet.

m. Stainless steel flanged feet with two holes at all front legs, secure to floor with two non corrosive anchors.

n. Weld in partition NO SPLIT BOWLS allowed.

o. Three 19" X 26½" X 15" deep (12" deep from top) 14 gauge stainless steel coved corner sinks.

p. One approximately 21" long 14 gauge stainless steel coved corner integral drainboards.

q. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½" and back ½" on a slight angle and at all walls turn up 2".

r. One T & S B-231-CR faucet with ceramic cartridges.

s. One T & S B-0184 faucet with spray hose and ceramic cartridges.

t. Fisher 22411*M126 lever handle drain(s) with 14 gauge stainless steel handle bracket secure to sink bottom with weld studs and stainless steel acorn nuts, hole in bracket 1/8" maximum larger (LARGE HOLE OR ELONGATED SLOT IS NOT ALLOWED) than handle diameter. MODIFIED drain handle length (reduce or extend) to make the drain handle flush with the face of the sink bowl.

u. 16 gauge stainless steel removable overshelf mounted on 1 5/8" outside diameter tubing supports through splash secured to brackets fully welded to legs, 2" X 3/16" stainless steel band fully weld to brackets full length and stainless steel double sided pot hooks 8" on centers. Mount 60" above finished floor (66" at pot sink/dishtable), verify height with owner. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls (rear).

v. Z clip splash to wall, unexposed.

w. Channels shall be welded to each other with a 1"x1" x 4" x 1"x 1" continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.

x. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.

y. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

N. Item 15 – Table with heat lamp – one required

1. Fabricated according to details, drawings and specifications, 36" high to top.

2. Provide the following:

a. Depth to match item 26 fryer.

b. 14 gauge stainless steel one piece coved corner top.

c. Top turned down 1½" and back ½" on a slight angle on all free sides.

d. Copper flashed weld studs capped with stainless steel acorn nuts.

e. ¾" tacky tape between all metal surfaces, installed to create a vermin proof seal.

f. Two 14 gauge stainless steel hat channels full length, fully welded to end channels. DO NOT OMIT OR NOTCH CHANNELS FOR DRAWER FRAME

g. Stainless steel gussets fully welded to channels.

h. 1 5/8" 16 gauge stainless steel tubing legs.

i. 1 5/8" 16 gauge stainless steel tubing crossrails fully welded to legs.

j. Stainless steel adjustable bullet feet.

k. 16 gauge stainless steel removable overshelf mounted on 1 5/8" outside diameter tubing supports through splash secured to brackets fully welded to legs, 2" X 3/16" stainless steel band fully weld to brackets full length and stainless steel double sided pot hooks 8" on centers. Mount 60" above finished floor (66" at pot sink/dishtable), verify height with owner. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls (rear).

l. Channels shall be welded to each other with a 1" x 4" x 1" continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.

m. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.

n. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

o. Hatco GRFFBL heat lamp, 120/1 with cord and plug.

O. Item 16 – 8 quart mixer – one required

1. Kitchen Aid Commercial KSMC895WH,120/1 with cord and plug and standard accessories.

P. Item 17 – 60 quart mixer – one required

1. Hobart HL6000.
2. Provide the following:
   a. 208/1 with cord and plug.
   b. 60 quart stainless steel bowl.
   c. 60 quart B beater.
   d. 60 quart D wire whip.

e. 60 quart ED dough hook.

f. Ingredient chute.

g. Lexan splash cover.

h. Rubber foot pads.

Q. Item 18 – 20 Quart mixer – one required

1. Hobart HL200.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. 20 quart stainless steel bowl.
   c. 20 quart B beater.
   d. 20 quart D wire whip.
   e. 20 quart ED dough hook.
   f. Ingredient chute.
   g. Lexan splash cover.
   h. Rubber foot pads.
   i. Piper MX-29-TSS stand with MX-52-R accessories rack.

R. Item 19 – Not used.

S. Item 20 – Food processor – one required

1. Robot coupe CL50.
2. Provide the following:
   a. 120/1 with cord and plug
   b. Sixteen disc package, in addition to the standard disc package included.
   c. 5/16” dicing plate kit.

T. Item 21 – Can opener – one required

1. Edlund 270, 120/1 with cord and plug.

U. Item 22 – Heater and proofer cabinet – one required

1. Metro C539-CLFC-U-GY.
2. Provide the following:
   a. 120/1/1 with cord and plug, low watt 12 amps.
   b. Hinge door left.
   c. Grey color.

V. Item 23 – Ice cream freezer – one required

1. Master built DC-2S-SE.
2. Provide the following:
   a. 120/1 with cord and plug
   b. SE all stainless steel cabinet.
   c. Casters.

W. Item 24 – Heated dipperwell – one required

1. Server CW-DI 87770.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Cut out in counter top by others.

X. Item 25 – Combi oven, double stacked – one required

1. Rational, 6 pan full size, iCombi Pro, double stacked.
2. Provide the following:
   a. iCombi Pro on top iCombi Pro on bottom, double stacked.
   b. Full size, 18 x 26 sheet pan sized cooking chamber.
   c. Six level hinging rack for each section.
   d. Natural gas, each unit.
   e. 208/1 with cord and plug, each unit.
   f. Installation kit(s), one for each section.
   g. One 8” high stainless steel fixed leg kit.

h. Four (eight total) stainless steel wire grid shelves for each oven section.

i. Six 12” x 20” fry baskets.

j. Two chicken and duck racks.

k. Two potato baker racks.

l. Two rib racks.

m. One Vari smoker, do not mount to the door.

n. PROVIDED BY THE KITCHEN EQUIPMENT CONTRACTOR IN THE DRAIN PIPES, Two required 2” diameter Cool Drain Flow, Inc drain water tempering valve sized to reduce drain water to below 140 degrees. Provided by KITCHEN EQUIPMENT CONTRACTOR not provided by plumber or Rational. REQUIRED TO PREVENT PVC DRAIN PIPE FROM MELTING. Two required.

o. Water pressure regulator required for proper operation. Provided by KITCHEN EQUIPMENT CONTRACTOR not provided by plumber or Rational.

p. Backflow preventer required for proper operation. Provided by KITCHEN EQUIPMENT CONTRACTOR not provided by plumber or Rational.

q. Test local water source with free kit provide by Rational. Water quality that does not meet Rational standards may require proper water conditioning at an additional cost.

r. Heat shield on control side when less than 14” from open flame, as required.

s. Rational certified service agency installation with receiving, delivery, set up and testing and connections, for fully operational units.

t. Two additional bucket of 150 active green clean tablets, four total.

u. Four hours onsite training with a Rational certified chef.

v. Two year onsite parts and labor warranty, each unit.

w. Five year steam generator warranty, each unit.

Y. Item 26 – Fryer – one required

1. Frymaster H55.

2. Provide the following:

a. 120/1.

b. Natural gas with pressure regulator, each unit.

c. Stainless steel fry pot, door and cabinet, each unit.

d. Fry pot cover, each unit.

e. Sediment tray, each unit.

f. Safe-T-Link HG-4D3/4”-48-SK gas hose kit with quick disconnect and swivel ends. Secure restraining device to wall/equipment. Coordinate gas hose size with equipment.

Z. Item 27 – Range – one required

1. US Range G60-4G36CR or equal by Southbend.
2. Provide the following:
   a. Four burners.
   b. 36” Griddle on left.
   c. Natural gas with pressure regulator.
   d. One 26” convection oven and one 26” standard oven.
   e. Thermostatic griddle with modulating snap-action control, 175° to 425° F.
   f. Piezo spark ignition for pilots on griddles.
   g. Stainless steel front and sides.
   h. Stainless steel back guard and high shelf.
   i. Stainless steel legs and adjustable feet.
   j. Reinforced high shelf for mounting item 28 broiler.
   k. Safe-T-Link HG-4E1”-48-SK gas hose kit with quick disconnect, double swivel ends. Coordinate hose size with equipment. Secure restraining device to the building wall and equipment.

AA. Item 28 – Overhead broiler – one required

1. US Range GIR60 or equal by Southbend.
2. Provide the following:
   a. 36” broiler.
   b. Natural gas with pressure regulator.
   c. Rear gas inlet.
   d. Interconnecting gas piping kit for range-mounting.
   e. Balance of back guard to have a stainless steel shelf.
   f. Salamander mounted on right of back guard.

BB. Item 29 – Counter top steamer – one required

1. Roundup DFW150, 230/1 with cord and plug.

CC. Item 30 – Hood – one required

1. Furnished and installed by the mechanical contractor.
2. Kitchen Equipment Contractor shall coordinate installation with kitchen equipment.

DD. Item 31– Fire control system – one required

1. Furnished and installed by the mechanical contractor.
2. Kitchen Equipment Contractor shall coordinate installation with kitchen equipment.

EE. Item 32 – Hand sink with end splashes – three required

1. Furnished and installed by plumbing contractor.
2. Kitchen Equipment Contractor shall coordinate installation with kitchen equipment.

FF. Item 33 – Bread rack – one required

1. Furnished and installed by vendor.

GG. Item 34 – Heated cabinet – one required

1. Metro C539-CLFC-U-GY.
2. Provide the following:
   a. 120/1/1 with cord and plug, low watt 12 amps.
   b. Hinge door left.
   c. Grey color.

HH. Item 35 – Toaster – one required

1. Hatco TQ-400 or equal by Waring.
2. Provide the following:
3. 120/1/1 with cord and plug.
4. 1800 watts.

II. Item 36 – Work table – one required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:
   a. 14 gauge stainless steel coved corner top. 36” high to top.
   b. 8” high splash at walls.
   c. All free sides turned down 1 ½” and back ½” on a slight angle.
   d. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½” and back ½” on a slight angle and turn up 2” at walls.
   e. Copper flashed weld studs capped with stainless steel acorn nuts.
   f. ¾” tacky tape between all metal surfaces, installed to create a vermin proof seal.
   g. Two 14 gauge stainless steel hat channels full length, fully welded to end channels.
   h. 1 5/8” 16 gauge stainless steel tubing legs.
   i. Stainless steel gussets fully welded to channels.
   j. Adjustable stainless steel bullet feet.
   k. Component Hardware S90-0020-N drawer with 14 gauge stainless steel four sided fully welded seamless frame. Install with stainless steel screws. Frame is removable from channels and drawer. DO NOT OMIT OR DELETE ANY CHANNELS. Locks with keys
   l. 16 gauge stainless steel overshelf mounted on 14 gauge stainless steel brackets, 2” X 3/16” stainless steel band fully weld to brackets full length and stainless steel double sided pot hooks 8” on centers. Mount 60” above finished floor (66” at pot sink/dishtable), verify height with faucet and owner. Free sides turned down 1 ½” and back ½” on a slight angle and turn up 2” at walls.
   m. Channels shall be welded to each other with a 1”x1” x 4” x 1”x 1” continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.
   n. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.
   o. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.
   p. Z clip splash to wall, unexposed.

JJ. Item 37– Panini Grill – one required

1. Equipex Panini VG.
2. Provide the following:
   a. 208/1 with cord and plug.
   b. Ribbed top and smooth bottom.

KK. Item 38– Microwave – one required

1. Panasonic NE-1054F, 120/1 with cord and plug.

LL. Item 39 – Soup hot well, counter top – two required

1. APW RW-2V or equal.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. 1200 watts.

MM. Item 40 – Work table – one required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:
   a. 14 gauge stainless steel coved corner top. 36” high to top.
   b. 34” deep top.
   c. 8” high splash at walls.
   d. All free sides turned down 1 ½” and back ½” on a slight angle.
   e. 18 gauge stainless steel undershelf where space allows notched and fully welded to legs. Free sides turned down 1 ½” and back ½” on a slight angle and turn up 2” at walls.
   f. Copper flashed weld studs capped with stainless steel acorn nuts.
   g. ¾” tacky tape between all metal surfaces, installed to create a vermin proof seal.
   h. Two 14 gauge stainless steel hat channels full length, fully welded to end channels.
   i. 1 5/8” 16 gauge stainless steel tubing legs.
   j. Stainless steel gussets fully welded to channels.
   k. Adjustable stainless steel bullet feet.
   l. Component Hardware S90-0020-N drawer with 14 gauge stainless steel four sided fully welded seamless frame. Install with stainless steel screws. Frame is removable from channels and drawer. DO NOT OMIT OR DELETE ANY CHANNELS. Locks with keys
   m. 16 gauge stainless steel overshelf mounted on 14 gauge stainless steel brackets, 2” X 3/16” stainless steel band fully weld to brackets full length and stainless steel double sided pot hooks 8” on centers. Mount 60” above finished floor (66” at pot sink/dishtable), verify height

with faucet and owner. Free sides turned down 1 ½" and back ½" on a slight angle and turn up 2" at walls.

n. Channels shall be welded to each other with a 1"x1" x 4" x 1"x 1" continuous weld, typical. Gussets shall be welded to channels or plate with a 360 degrees continuous weld, typical.

o. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

p. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.

q. Z clip splash to wall, unexposed.

NN. Item 41 - Hot food counter – one required

1. Duke TEHF-60.
2. Fabricated according to details, drawings and specifications.
3. Provide the following:
   a. 208/1 with cord and plug.
   b. NOTE 8'-0" long cord and plug, in place of standard 6' cord.
   c. 14 gauge stainless steel top.
   d. 34" deep top.
   e. 36" high to top.
   f. 900 watt sealed hot food wells with manifold drains and drain valve.
   g. Mater toggle switch with indicator lights.
   h. EXPRESSION DRAIN HANDLES.
   i. Drain valve handle with bracket to extend to face of base on operators side, each unit.
   j. Stainless steel base.
   k. Polyurethane casters two with brakes.

OO. Item 42 – Sandwich unit – one required

1. True TSSU-60-24M-B-ST-HC, 120/1 with cord and plug.

PP. Item 43 – Double overshelf – one required

1. Fabricated according to details, drawings and specifications.
2. Provide the following:

a. 14 gauge stainless steel one piece.

b. To sit on top of the low wall and return to cover top of end wall.

c. Free sides turned down 1½" and back ½" on a slight angle.

d. Notch outside corners 2" x 2".

e. Notch lower shelf at one end for hot food wells.

f. Junction box under top over shelf with concealed conduit to underside of bottom shelf for heat lamp

g. 1" od stainless steel tubing fully welded to top of bottom shelf to support top shelf.

h. Bracket for mounting heat lamp remote infinite control

i. 14 gauge stainless steel channels, angles brackets and fillers to secure overshelf to top of wall and fully support the shelf. Furnish all material and labor required for a complete installation. Secure brackets into building wall studs to adequately support the overshelf.

j. Below top overshelf provide 1½" clearance (air gap between heat lamp and overshelf).

k. 18 ga ss wall paneling from floor to underside of over shelf to cover wall behind item 40, 41 and 42 and on wall at left end of item 40.

l. 18 gauge stainless steel wall panel on the rear and one end of service wall approximately 60" high, secure to wall with a fire rated contact cement applied to the wall and paneling, only vertical seams no horizontal seams, and field cut openings for utility outlets and provide stainless steel cover plates for all outlets.

m. Component hardware stainless steel trim at all exposed sides of the panels and internal and external corners.

n. 14 gauge stainless steel one piece U shaped caps at ends of each wall.

o. Install level, true and square, make all adjustment and modifications required to fit the field conditions.

p. Seal all seams and gaps vermin proof with a 100% food grade silicone sealant.

q. All welding and stainless steel surfaces grind smooth and polished to a number 4 finish.

QQ. Item 44 – Heat lamp – one required

1. Hatco GR-60.

2. Provide the following:

a. 120/1.

b. Stainless steel.

c. Lead to reach electrical outlet.

d. Remote infinite control mounted below upper overshelf on a 14 gauge stainless-steel bracket.

e. Adjustable brackets for mounting.

f. Below overshelf provide 1½" clearance (air space between heat lamp and overshelf).

RR. Item 45 – Millwork counters – one lot required

1. Furnished and installed by millwork contractor.
2. Kitchen Equipment Contractor shall coordinate installation with kitchen equipment.

SS. Item 46 – Refrigerator – one required

1. Traulsen G20010 or equal by Continental.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Fourteen pair (seven each door) universal angle slides with mounting hardware.
   c. Reach in refrigerators and freezers must be from the same manufacture.

TT. Item 47 – Cold pan – one required

1. Hatco CWBP-4 or equal.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Pan set down 2" below top.
   c. Gasket, factory installed to seal flange to counter top without silicone.
   d. False bottom.
   e. 14 gauge stainless steel bracket in counter base for mounting remote controls.
   f. Cut out in counter top by others.

UU. Item 48 – Sneeze guard – one required

1. Premier metal and glass FM2N-G or equal.
2. Provide the following:
   a. Satin finish.
   b. 3/8" glass.

c. Glass with rounded corners.

d. Two end panels.

e. 641/1 above counter surface mount flanges.

f. LED display lights.

g. 14 gauge stainless steel bracket in counter base for mounting remote controls.

h. Cut out in counter top by others.

VV. Item 49 – Millwork counters – one lot required

1. Furnished and installed by millwork contractor.
2. Kitchen Equipment Contractor shall coordinate installation with kitchen equipment.

WW. Item 50 – Refrigerated grab and go, flush with countertop – one required

1. Federal URCSL4833S.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Stainless steel interior including step riser.
   c. Stainless steel shelf with LED light.
   d. Special exterior finish.
   e. Energy saving night cover.
   f. Condensate pump.
   g. 6” high legs. Unit to sit into millwork counter verify and coordinate with millwork contractor.
   h. Self contained refrigeration system.
   i. Verify and coordinate installation into the millwork counter.
   j. Rear of counter base open for air flow.
   k. Cut out in counter top by others.

XX. Item 51 – Refrigerated pastry case – one required

1. Federal ITR4826.
2. Provide the following:
   a. 120/1 with cord and plug.

b. Self contained refrigeration system.
c. Stainless steel exterior.
d. Condensate pump.
e. LED lights.
f. Energy saving night cover.
g. Verify and coordinate installation into the millwork counter.
h. Rear of counter base open for air flow.
i. Cut out in counter top by others.

YY. Item 52 – POS system – one lot required
1. Furnished and installed by owner.

ZZ. Item 53 – Coffee dispenser – one lot required
1. See Item 65 coffee brewer.

AAA. Item 54 – Undercouter refrigerator – two required
1. True TUC-24-HC, 120/1 with cord and plug.

BBB. Item 55 – Espresso head with generator – one required
1. La Marzocco, Modbar, AV-1 Group + Steam.
2. Provide the following:
a. 208/1 with cord and plug each unit.
b. Polished finished.
c. Drip trough with scale for AV-1.
d. Drip trough for Steam
e. Generator for espresso and generator for steam.
f. La Marzocco, Modbar water filter for espresso and steam generators.
g. Verify and coordinate installation into the millwork counter.
h. Ventilation in counter base open for air flow.

i. 18” x 24” double (two shelves) height stainless steel wire shelf for the generators to sit on in the counter base, four post 30” high, verify and coordinate size and height with installation.

j. Cut out in counter top by others.

CCC. Item 56 – Steam head with generator – one required

1. La Marzocco, Modbar, see item 55.
2. Provide the following:
   a. See item 55

DDD. Item 57 – Espresso grinder – one required

1. La Marzocco, Modbar, Swan coffee grinder, 120/1 with cord and plug.

EEE. Item 58 – Rinser – one required

1. Advance SU-16.
2. Provide the following:
   a. Verify and coordinate installation into the millwork counter.
   b. Cut out in counter top by others.

FFF. Item 59 – Knock box – one required

1. Vollrath E0606-KB.
2. Provide the following:
   a. Modified and customized, reduce to 3” high, neatly and evenly cut bottom off and grind smooth, remove all sharp edges, on inside and outside edges.
   b. Seal to counter top with a 50 year food grade clear silicone.
   c. Verify and coordinate installation into the millwork counter.
   d. Cut out in counter top by others.

GGG. Item 60 – Trash can – two required

1. Rubbermaid 1971258, 25” high, 16 gallon, slim trash can, each unit.

HHH. Item 61 – Ice maker, cubed – one required

1. Manitowoc IYT0620A or Scotsman equal,
2. Provide the following:
   a. 120/1.
   b. Adaptor(s) required for ice maker to mount on bin.
   c. D570 stainless steel bin.
   d. Cuno ICE120-S water filter. DO NOT MOUNT WATER FILTER BEHIND ICE MAKER.

III. Item 62 – Sink, drop in – one required

1. Furnished and installed by the plumbing contractor.

JJJ. Item 63 – Ice chest, drop in– two required

1. Delfield 305.
2. Provide the following:
   a. Verify and coordinate installation into the millwork counter.
   b. Cut out in counter top by others.

KKK. Item 64 – Blender – three required (three future not in contract)

1. Future, not in contract, all three future.

LLL. Item 65 – Coffee brewer – one required

1. Bunn o matic 53001.0100.
2. Provide the following:
   a. 120/208/1.
   b. One 39000.0004 water filter.
   c. Install water filter below in counter base.
   d. Six 32125.0000 airpot.

MMM. Item 66 – Coffee grinder – one required

1. Bunn o matic 24250.0021.

2. Provide the following:
    a. 120/1 with cord and plug.

NNN. Item 67 – Tea brewer – one required

1. Furnished and installed by vendor.

OOO. Item 68 – Tea dispenser – two required

1. Furnished and installed by vendor.

PPP. Item 69 – Soda system – one required

1. Furnished and installed by vendor.

QQQ. Item 70 – Cup dispenser – one required

1. San Jamar C2804.

RRR. Item 71 – Bag in box rack – one required

1. Furnished and installed by vendor.

SSS. Item 72 – Trash can, slim, bar – one required

1. Rubbermaid FG354060GRAY with FG267360GRAY lid.

TTT. Item 73 – Hand sink, bar – one required

1. Eagle HS12-19 MODIFIED or equal.
2. Provide the following:
    a. Back bar equipment shall be furnished by one manufacturer.
    b. B-1110-187XWSCR faucet with ceramic cartridges.
    c. Stainless steel gussets.
    d. Stainless steel legs.
    e. Stainless steel feet.

f. Modified and customized, cut and notch splash to fit below the ADA bar counter area. Neatly notch the splash, fully weld in stainless steel filler(s) to cover notch. Grind welding smooth and polish to a number 4 finish.

UUU. Item 74 – Work top, bar – two required

1. Eagle WB2-18 (24” wide) or equal.
2. Provide the following:
   a. Single tier speed rail, each unit.
   b. Stainless steel gussets, each unit.
   c. Stainless steel legs, each unit.
   d. Stainless steel feet, each unit.

VVV. Item 75 – Blender, bar – one required (future not in contract)

1. Future, not in contract.

WWW. Item 76 – Blender station with dump sink, bar – one required

1. Eagle BS14-19 or equal.
2. Provide the following:
   a. B-1110-187XWSCR faucet with ceramic cartridges.
   b. Stainless steel gussets.
   c. Stainless steel legs.
   d. Stainless steel feet.

XXX. Item 77 – Cocktail unit, bar – one required

1. Eagle B2CT-18-7 (24” wide) or equal.
2. Provide the following:
   a. Built in 7 circuit cold plate for soda system.
   b. Single tier speed rail.
   c. Sliding lid.
   d. Stainless steel gussets.

e. Stainless steel legs.

f. Stainless steel feet.

YYY. Item 78 – Sparkling water dispenser – two required

1. Blupura T-Flow 3W, polished stainless steel.
2. Provide the following:
   a. Sparkling water, cold water and ambient water
   b. Polished stainless steel finish, each unit.
   c. Two top mounted drainer, Perlick C18640A, one each unit.
   d. For outdoor unit Raychem H612, 120/1, wet location winter guard self regulating drain line heat tape(s) with connection kits and H912 gel fill end seal kits. One piece tape with no tees or splices. Heat tape of sufficient length and installed to prevent freezing of water pipes provide plug or hard wire to outlet.
   e. Verify and coordinate installation into the millwork counter.
   f. Cut out in counter top by others.
   g. Labor and materials for all water piping by the plumber.

ZZZ. Item 79 – Soda gun with carbonator, bar – one required

1. Furnished and installed by vendor.

AAAA. Item 80 – Glass washer, bar – one required

1. CMA GW-100.
2. Provide the following:
   a. 120/1 with cord and plug.

BBBB. Item 81 – Wine cooler, white/red – two required

1. Vinotemp VT-PRWINEDIS4S stainless steel.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Stainless steel finish.
   c. Verify and coordinate installation into the millwork counter.

d. Cut out in counter top by others.

CCCC. Item 82 – Beer cooler, bar – one required

1. Perlick BBS60.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Refrigeration system on right.
   c. Cabinet stainless steel.
   d. Solid stainless steel doors.
   e. 24” stainless steel door handles.
   f. Verify and coordinate installation into the millwork counter.

DDDD. Item 83 – Beer tap, bar – one required

1. Perlick 4073-6PO-SS Avenue T pipe tower.
2. Provide the following:
   a. Top mounted drainer, C18650A.
   b. Black tap handles.
   c. Openings in counter top for tap, trunk and drip trough by others.
   d. All components required for a complete operational beer dispensing system, see item 90 power pack.
   e. Kitchen equipment verify and contractor to coordinate bar construction with beer dispensing equipment.
   f. Installation and assembly according to Perlick instructions and details. Start up, calibration and demonstration by Perlick factory authorized service agency.
   g. Verify and coordinate installation into the millwork counter.
   h. Cut out in counter top by others.

EEEE. Item 84 – Glass chiller, bar – one required

1. Perlick HC24FS4.
2. Provide the following:
   a. 120/1 with cord and plug.

b. Cabinet stainless steel.

c. Solid stainless steel door.

d. 24” stainless steel door handle.

e. Hinge door left.

f. Verify and coordinate installation into the millwork counter.

FFFF. Item 85 – Wine cooler, bar – one required

1. Sumit182Z.
2. Provide the following:
   a. 120/1 with cord and plug.
   b. Dual zone temperature control half red wine and half white wine.
   c. Hinge door left.
   d. Verify and coordinate installation into the millwork counter.

GGGG. Item 86, 87 and 88 – Beer cooler with refrigeration system, 34 degrees – one required

1. See Item 1 and 2, floorless, omit door peep window.

HHHH. Item 89 – Keg rack – two required

1. New age.
2. Provide the following:
   a. One 1842HD with T bar laterals, each unit.
   b. Four 48P post, each unit.
   c. Two 1842UB brace, one at top and one at bottom, two for each unit.
   d. Modified and customized as required, verify and coordinate height to fit into item 86 beer cooler below evaporator coil.

IIII. Item 90 – Beer power pack – one required

1. Perlick 4410.
2. Provide the following:
   a. 120/1 with cord and plug.

b. Power Cord Kit for 4404 & 4410 Single Pump Units.

c. Adjustable Legs.

d. Overflow Bottle Kit.

e. Food Grade Glycol pre-mix.

f. Coolant Backflow Preventer Kit.

g. Stainless Steel Table Stand.

h. Wall Bracket for 4404 & 4410.

i. Optional Second Year Parts and Labor Warranty.

j. Tower item 90.

k. 4220-16-1 trunk housing with water proof jacket to bar upstairs.

l. 3/8” color coded product lines.

m. ½” copper coolant lines.

n. Regulator beer pump panels for each product line.

o. Couplers for product line connection to the kegs.

p. For trunk run strap trunk to structure in a secure manor to prevent damage with Perlick hangers.

q. McDantim Trumix 668 double nitrogen blender all components required for connection to the beer dispensing system. Wall mount this unit near co2 tank.

r. Include in quote half of products faucets, fittings and couplers for, craft beers and guinness, beers and provide all components required a complete operational dispensing system.

s. Verify and coordinate with owner products to be dispensed from this system.

t. All components, material and labor required for a complete operational draft beer dispensing system (less kegs of product), so client can tap kegs, fill lines, open faucets and dispense cold beer.

u. Kitchen equipment contractor to coordinate bar construction with beer dispensing equipment.

v. Installation and assembly according to Perlick instructions and details. Start up, calibration and demonstration by Perlick factory authorized service agency.

JJJJ.Item 91 – Sparkling water dispenser, cooling unit – one required

1. Box 80 Plus Fizz.
2. Provide the following:

a. 208/1.

b. Custom fabricated 18” high stand, see item 36 or 40 item for specifications.

c. Sized for two T flow 3W dispensers.

d. Less than 50’ distance from the dispensers.

e. Filter + head.

f. UVC Led in.

g. Recirculating Pump.

h. Water block.

i. Water pressure reducer.

j. CO2 pressure reducer.

k. Incremental digital line counter 6000R.

l. All components, material and labor required for a complete operational sparkling water dispensing system.

m. Labor and materials for all water piping by the plumber.

2.5 ITEMIZED PRICES

1. Bidders that do not provide itemized prices for all specified Kitchen Equipment will be rejected.
2. List prices for alternates to specified items on a separate sheet with specifications.
3. Itemized prices may be submitted in Auto Quotes format or spread sheet.

Equipment Sub total (equipment only no labor) _____

State Taxes (equipment only no labor) _____

Local/County Taxes _____

Bond (when required) _____

Installation Labor _____

Total Bid Price _____$_____

PART 3 – EXECUTION

3.1 Installation of Kitchen Equipment

A. Unload, uncrate, assemble, set-in place, hang, level and adjust Kitchen Equipment. Tag parts shipped loose. Furnish necessary installation instructions. Clean up all trash immediately upon completion of installation and remove from the project site.

B. Neatly seal gaps of ¼" or less between Kitchen Equipment and walls, other equipment and floors with a "50 year" food grade clear silicone sealant. Seal gaps of ¼" or more with 14 gauge stainless steel trim fully welded ground smooth and polished to No. 4 finish or neatly attach trim with concealed stainless steel blots and nuts silicon trim to wall.

C. Erect Kitchen Equipment at project site in full compliance with the codes and regulations of the state and local Health Department.

D. Remove all protective coatings and other markings from Kitchen Equipment before demonstration. Wash with soap and water, rinse clean and dry spotless.

E. Provide a competent foreman at the project site to supervise installation of all Kitchen Equipment, and to coordinate with other trades in reference to connections at time of installation. Tag and deliver plumbing and electrical parts, furnished loose and specified as part of the Kitchen Equipment to respective installing trades.

F. Provide all Zee clips and angles necessary for wall mounting of Kitchen Equipment.

G. Any sleeves, flanges of anchor bolts required to be built in to building structure to be provided to respective trades.

3.2 TESTING, CALIBRATION AND DEMONSTRATION

A. After completion of final connection by respective trades, test and calibrate Kitchen Equipment for proper operation. Make any necessary adjustments and re-test, repair or replace Kitchen Equipment producing objectionable noise.

B. Repair finishes marred during handling and installation or replace if required by the owner or consultant.

C. Schedule demonstration of Kitchen Equipment with manufacturer's representatives, and owner's personnel.

D. Provide pictures of completed punch list deficiencies to Contractor, Architect Owner and Consultant for review after all punch list work has been completed.

END OF SECTION

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL V.20

1.01 SECTION INCLUDES

A. Manual Roller Shades.

B. Interior motorized roller shades.

C. Motor controls.

1.02 RELATED REQUIREMENTS

A. Section 26 2726 - Wiring Devices: Finish requirements for wall controls specified in this section.

1.03 REFERENCE STANDARDS

A. ASTM E2180 - Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) in Polymeric or Hydrophobic Materials; 2018.

B. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

C. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015.

D. WCMA A100.1 - Safety of Corded Window Covering Products; Current Edition, Including All Revisions.

E. ATCC - American Type Culture Collection; ATCC 9642, ATCC 9644, and ATCC 9645 are specific fungal reference strains curated by the American Type Culture Collection (ATCC) and are widely designated for standardized fungus resistance testing of polymers and plastics (such as ASTM G21).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
   2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

C. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.

C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.

D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.

E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.

F. Selection Samples: Include fabric samples in full range of available colors and patterns meeting specified performance requirements.
   1. Shadecloth Sample:
      a. Mark face of material to indicate interior face.
      b. Include test reports indicating compliance with specified fabric properties.
      c. Sample size: 6-inch by 6-inch minimum, representing actual material, color and pattern.
   2. Motorized Shades: Include finish selections for controls.

G. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.

I. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

J. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

K. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Source Requirements: Obtain shade systems through one source from a single manufacturer.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of this type with minimum two years of documented experience with shading systems of similar size and type.

D. Fire-Test-Response Characteristics: Passes NFPA 701 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.

E. Electrical Components: NFPA Article 100 listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system. Individual testing of components will not be acceptable in lieu of system testing.

F. Requirements for Electronic Hardware, Controls, and Switches: Roller shade hardware, shade fabric, EDU (Electronic Drive Unit), and all related controls shall be furnished and installed as a complete two-way communicating system and assembly.

G. ShadeCloth Anti-Microbial Characteristics: 'No Growth' per ASTM G21 results for fungi ATCC9642, ATCC9644 and ATCC9645, and ASTM E2180.

H. Turn-Key Single-Source Responsibility for Motorized Shades: Assign the design, engineering, and installation of motorized roller shade systems, motors, controls and low voltage electrical control wiring specified in this Section to a single manufacturer and their authorized installer/dealer.

1.07 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
   1. Locate where directed.
   2. Full-sized mock-up may become part of the final installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in Window Schedule.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 PROJECT CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Install shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Chain and Hardware: 25 years.
   2. Fabric / Shadecloth: 25 years.
   3. Electric Motors: Ten years.
   4. Electronic Control Equipment: Ten years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   3. MechoShade Systems LLC; Mecho/5 System: www.mechoshade.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Motorized Roller Shades, Motors and Motor Controls:
   1. Basis-of-Design: MechoShade Systems LLC; UrbanShade Single Roller - Motorized: www.mechoshade.com/#sle.
   2. Draper, Inc; Motorized FlexShade: www.draperinc.com/#sle.
   3. Hunter Douglas Architectural; RB500 Motorized Roller Shades: www.hunterdouglasarchitectural.com/#sle.
   4. Levolor: www.levolor.com/commercial/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements..

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Manual Roller Shades for Offices and Conference Room (House and Maintenance):
   1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
      a. Drop Position: Regular roll.
      b. Roll Direction: Roll down, closed position is at window sill.
      c. Mounting: Window jamb mounted- inside, between jambs.
      d. Size: As indicated on drawings.
      e. Fabric: As indicated under Shade Fabric article.
      f. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; finish to be selected from manufacturers full range.

C. Motorized Roller Shades for Garden Room - Basis of Design: MechoShade Systems LLC; ElectroShade with WhisperShade IQ2 EDU, line voltage (120 VAC); www.mechoshade.com/#sle.
   1. Description: Single roller, motor operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
   2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   3. Roller Tubes:
      a. Material: Extruded aluminum.
      b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
      c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge. Shade band to be removable and replaceable without removing roller tube from brackets or inserting spline from the side of the roller tube.
   4. Hembars: Designed to maintain bottom of shade straight and flat.
   5. Intelligent Encoded Electronic Drive System:
      a. Line Voltage EDU (120 VAC):
         1) Audible Noise: 46 dBA or less measured 3 feet from the motor unit, depending on motor torque.
      b. Modes of Operation:
         1) Uniform Mode: Allows for shades to move only to defined intermediate stop positions in order to maintain aesthetic uniformity.
         2) Normal Mode: Allows for shades to move to defined intermediate stop positions plus any position between defined upper and lower limits.
         3) Maintenance Mode: Prevents shade from moving to newly commanded positions via dry contact or network control commands until EDU has been serviced and/or Maintenance Mode has been cleared/disabled.
      c. Control Methods: Support both local isolated dry contact input and network control.
         1) Local isolated dry contact inputs support local switch control and third party system integration without separate interface.
         2) Bi-directional network communication enables commanding the operation of large groups of shades over a common backbone.
         3) Provide a minimum of three customizable preset positions accessible over the local dry contact control inputs and over the network connection.
         4) Provide a minimum of 32 customizable preset positions (including the three local switch presets) accessible via network commands.
   6. Accessories:
      a. Fascia: Removable extruded aluminum fascia, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish. Custom color to match window mullions.

2.03 SHADE FABRIC

A. Fabric: Non-flammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
   1. Manufacturers:
      a. Phifer, Inc; Sheerweave: www.phifer.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Material: Vinyl coated polyester, single thickness non-raveling 0.030-inch (0.762 mm) thick, woven from 0.018-inch (0.457mm) diameter extruded vinyl yard compromising of 21 percent polyester and 79 percent reinforced vinyl.
   3. Performance Requirements:
      a. Flammability: Pass NFPA 701 large and small tests.
      b. Fungal Resistance: No growth when tested according to ASTM G21.
      c. Noise Reduction Coefficient: NRC = 0.55.

4. Color: As selected by Architect from manufacturer’s full range of colors.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Digital Network Controls:
   1. Intelligent Motors and Devices: Identifiable over network without separate interface.
   2. Capable of reprogrammed control without requiring wiring modifications.
   3. Capable of assigning shade motors to shade groups/sub-groups.
   4. Capable of storing programmable open and close limits and minimum of three intermediate preset stop positions for each shade.
   5. Capable of aligning adjacent shades within accuracy of plus/minus 0.25 inch.
   6. Basis of Design:
      a. MechoShade Systems LLC; MechoNet: www.mechoshade.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 3/4 inch total.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for closeout submittals.

B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.08 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

END OF SECTION

SECTION 13 34 00 EXTERIOR TRELLIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. See Section 06 10 63, Exterior Rough Carpentry, for requirements related to wood trellis and pergola components.

1.2 SUMMARY

A. A. Section Includes:
1. Pergola – Natural Log.
2. Trellis - Columns.
3. Metal Arches.
4. Aluminum canopy and metal trellis components.
5. Cast stone column components and associated structural infill.
6. Fasteners, anchors, grout, and accessories required for complete installations.

B. B. Coordinate exterior trellis work with adjacent paving, planting, structures, foundations, drainage, irrigation, lighting, and other site improvements.

C. C. Provide complete assemblies capable of supporting design loads and maintaining alignment, appearance, and durability throughout the Work.

1.3 1.3 DEFINITIONS

A. A. Boards: Lumber of less than 2 inches nominal (38 mm actual) in thickness and 2 inches nominal (38 mm actual) or greater in width.

B. B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm) in least dimension.

C. C. Timber: Lumber of 5 inches nominal (114 mm) or greater in least dimension.

D. D. Lumber grading agencies, and the abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

E. E. FSC (Forest Stewardship Council) – All wood products designated in the specification as “FSC certified.”
1. Certified Well-Managed Forests: Forests certified to be in compliance with the standards endorsed by the Forest Stewardship Council (FSC).
2. FSC-certified Wood Products: Products milled or otherwise altered by manufacturers certified to be in compliance with the standards endorsed by the Forest Stewardship Council.

1.4 1.4 ACTION SUBMITTALS

A. Shop Drawings: Show field-measured dimensions of entire composition; individual dimensions of all pieces; proposed hardware types, sizes, finishes, and connection details.
1. Include plans, elevations, sections, enlarged details, and details of fabrications and their connections.
2. Show anchorage, foundations, accessory items, blocking, structural interfaces, and attachment to adjacent construction.
3. Indicate material types, grades, species, sizes, finishes, welds, fasteners, joints, and tolerances.
4. Show transitions between wood, aluminum, cast stone, concrete, and other dissimilar materials.
5. Identify all field connections and indicate which connections are shop fabricated and which are field assembled.

B. Product Data: For wood preservatives, coatings, sealants, fasteners, anchors, grout, concrete additives, powder coating, and other proprietary materials.

C. C. Samples: For each type and finish.
1. Wood products.
2. Cast stone color samples.
3. Metal with powder-coated finish.
4. Fastener and hardware samples when requested by Landscape Architect.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates:
1. For all wood products designated in this Specification as “FSC certified,” provide evidence of compliance with FSC standards as follows.
2. Demonstrate that products are FSC certified by providing vendor invoices. Invoices shall contain the vendor’s Chain-of-Custody (COC) number and identify each FSC certified product on a line-item basis.
3. Wood products without submittal of acceptable documentation will be rejected.
4. Fasteners.
5. Shop primers.
6. Shrinkage resisting grout.
7. Prefabricated building columns.

B. Evaluation Reports: For preservative-treated wood products, from ICC-ES.

C. Certificates of Inspection: Issued by lumber grading agency for exposed wood products not marked with grade stamp.

D. Manufacturer's installation instructions for cast stone columns, metal trellis components, and proprietary systems.

E. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. All wood products designated as “FSC certified” in this Specification shall be certified according to the rules of the Forest Stewardship Council (www.fscus.org).

B. Lumber grading: Provide lumber graded and marked in accordance with the applicable grading agency requirements.

C. Fabricator Qualifications: Firm experienced in fabricating exterior timber, aluminum, cast stone, and ornamental trellis assemblies of similar scope and complexity.

D. Installer Qualifications: Installer experienced with exterior wood and metal trellis construction, cast stone components, structural anchorage, and finish protection.

E. Manufacturer Qualifications: Manufacturers of proprietary cast stone, fasteners, coatings, and specialty components shall have a minimum five years documented experience producing products of the type specified.

F. Source Limitations: Provide each type of proprietary product from a single manufacturer.

G. Mockup: Before fabrication or production work, construct a representative mockup in location requested by Landscape Architect. Include representative wood, cast stone, aluminum, joints, fasteners, finish, and connection conditions. Approved mockup may remain as part of completed Work if undisturbed.

1.7 PREINSTALLATION CONFERENCE

A. Conduct a preinstallation conference approximately two weeks before scheduled commencement of the Work.
   1. Review field dimensions, foundations, anchorage, material interfaces, sequence of installation, finish protection, and coordination with adjacent work.
   2. Review procedures for handling and installation of cast stone and wood components.
   3. Review requirements for field modifications and protection of finished surfaces.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials under cover and protected from weather and contact with damp or wet surfaces.

B. Stack lumber flat with spacers between each bundle to provide air circulation. Provide air circulation around stacks and under coverings.

C. Store cast stone on padded supports and protect from chipping, staining, impact, and contact with soil.

D. Protect aluminum and finished metal components from scratching, denting, deformation, contamination, and galvanic contact with incompatible materials.

E. Do not use finished components as supports, ladders, work platforms, or storage racks.

F. Replace materials damaged during delivery or storage that cannot be restored to specified condition.

1.9 PROJECT CONDITIONS

A. Verify field dimensions, grades, and supporting conditions before fabrication.

B. Do not fabricate structural or visually critical components solely from scaled Drawings.

C. Coordinate installation with foundations and other supporting construction.

D. Do not install components until supporting substrates and foundations are sufficiently complete and capable of receiving the Work.

E. Protect existing vegetation and adjacent finished work during excavation, lifting, and installation.

1.10 WARRANTY

A. Provide manufacturer's standard warranty for proprietary products.

B. Installer shall warrant installation workmanship against defects attributable to improper installation, defective connections, or failure to comply with approved Shop Drawings and manufacturer's written instructions.

C. Correct defective Work at no additional cost to Owner.

PRODUCTS

2.1 LUMBER, GENERAL

A. A. Comply with DOC PS 20 and with grading rules of lumber grading agencies certified by ALSC's Board of Review as applicable. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by ALSC's Board of Review.
   1. Factory mark each item with grade stamp of grading agency.
   2. For items exposed to view in completed Work, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Wood products identified through research as being available from FSC-certified sources shall be specified on a line-by-line basis as “FSC-certified.”

C. Maximum Moisture Content:
1. Boards: 19 percent.
2. Dimension Lumber: 19 percent.
3. Timber: 19 percent.

D. D.Select exposed wood for straightness, uniformity, and freedom from defects that would impair structural performance or finish appearance.

2.2 PERGOLA: NATURAL LOG

A. Hand select wood for freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot holes, shake, splits, torn grain, and wane.

B. Only one species may be used on all elements.

C. Wood Species:
1. 1. Black Locust.
2. 2. Approved equal.

D. Size and Dimensions: As per Drawings.

E. Fasteners: Stainless steel, galvanized, or approved equal. Provide corrosion-resistant fasteners compatible with wood treatment, finish, and adjacent metal.

F. Provide members straight and true, with ends and cuts cleanly finished.

G. Provide concealed connections where indicated. Exposed fasteners shall be aligned consistently and installed without damaging adjacent surfaces.

2.3 TRELLIS - COLUMNS

A. Canopy Material: Aluminum, Powder coated, RAL 6021 Black Green.

B. Size: As per Drawings.

C. Welds: Sand and grind all welds smooth.

D. Columns: M7 Cast Stone Column, Haddonstone Tuscan Pilaster M7 Short Shaft Full Column.
1. Capital M750M.
2. Shaft: M750R, M750S, M750U.

3. Base: M750F.
4. Pedestal M750H.
5. Quantity: 4.

E. Cast stone components shall be free of cracks, chips, spalls, stains, warping, or other defects visible at normal viewing distance.

F. Coordinate dimensions of cast stone components with structural core, anchorage, and aluminum framing before fabrication.

2.4 METAL ARCHES

A. Material: Aluminum, Powder coated, RAL 6021 Black Green.

B. Size: As per Drawings.

C. Welds: Sand and grind all welds smooth.

D. Fabricate arches accurately to required curvature and dimensions. Provide rigid, true, and uniform assemblies free of visible distortion.

E. Powder-coated finish shall be continuous and uniform, free of runs, blisters, pinholes, exposed substrate, or visible coating damage.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated, acceptable to authorities having jurisdiction, and that comply with requirements specified in this Article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Use stainless steel unless otherwise indicated.

B. Nails: ASTM F 1667.

C. Power-Driven Fasteners: ICC-ES AC70.

D. Wood Screws and Lag Screws: ASME B18.2.1, ASME B18.6.1, or ICC-ES AC233.

E. Stainless-Steel Bolts: ASTM F 593, Alloy Group 1 or 2 (ASTM F 738M, Grade A1 or Grade A4); with ASTM F 594, Alloy Group 1 or 2 (ASTM F 836M, Grade A1 or Grade A4) hex nuts and, where indicated, flat washers.

F. Postinstalled Anchors: Stainless-steel, torque-controlled expansion anchors with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing according to ASTM E 488, conducted by a qualified independent testing and inspecting agency.

1. Stainless-steel bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or Grade A4).

G. Isolate dissimilar metals where required to prevent galvanic corrosion.

2.6 CAST STONE AND GROUTING MATERIALS

A. Cast Stone: Haddonstone components (or approved equal) specified in Section 2.3, manufactured for exterior exposure and suitable for the intended application.

B. Mortar: 1:1:6 cement/lime/sand mortar or similar, compatible with cast stone and approved by manufacturer.

C. Pointing: Haddonstone (or approved equal) color-matched dry mix in accordance with manufacturer's written instructions, or color-matched bedding mix where approved.

D. Compressible Filler: Exterior-grade compressible material suitable for forming soft joints between cast stone and structural components.

E. Concrete Infill: Concrete suitable for reinforced filling of hollow cast stone cores, with rounded gravel aggregate approximately 10 mm maximum size, medium to high workability, and compatible with structural requirements.

F. Plasticizing Admixtures: Proprietary admixtures suitable for concrete infill and used only in accordance with manufacturer's written instructions.

2.7 METAL FINISHES

A. Powder coating: Exterior-grade powder-coat system suitable for aluminum and exposure conditions. Color: RAL 6021 Black Green.

B. Finish samples shall be approved by Landscape Architect before production.

C. Repair damaged finish using materials and procedures approved by coating manufacturer. Repairs shall match surrounding finish as closely as practicable.

D. Exposed welds shall be ground and finished smooth without reducing required member thickness or compromising structural integrity.

PART 3 - EXECUTION

3.1 PREPARATION

A. The Contractor shall mark out all locations of the exterior trellises prior to construction. Location to be approved by Landscape Architect.

B. Verify dimensions, elevations, grades, foundations, structural supports, and clearances before fabrication and installation.

C. Verify that supporting construction is ready to receive trellis components. Notify Landscape Architect in writing of unsatisfactory conditions before proceeding.

D. Protect adjacent paving, planting, structures, and finished surfaces from damage during installation.

3.2 INSTALLATION - WOOD PERGOLA

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.

B. Framing Standard: Comply with AF&PA WCD1 unless otherwise indicated.

C. Install metal framing anchors to comply with manufacturer's written instructions.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of members or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
3. 1. ICC-ES AC70 for power-driven fasteners.
4. 2. "Fastening Schedule" in ICC's International Building Code.

H. Use common wire nails unless otherwise indicated. Select fasteners of size that do not fully penetrate members where opposite side is exposed to view. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads unless otherwise indicated.

I. Maintain consistent joints, alignments, and exposed fastener patterns. Do not force warped members into position.

J. Seal field cuts and drilled penetrations in treated or finished wood with compatible preservative or end-cut treatment recommended by the wood treatment manufacturer.

3.3 INSTALLATION METAL ARCHES AND COLUMNED TRELLISES

A. COLUMNED TRELLIS
1. Haddonstone columns (or approved equal) supplied as nonstructural decorative cladding with a hollow central core.
2. Hollow core to be filled with reinforced concrete.
3. Foundations: A column should be erected on a suitable foundation, designed to suit loadings and ground conditions.
4. Bedding and Jointing: All components should be bedded and jointed using 1:1:6 cement/lime/sand mortar or similar.

a. Joints should be approximately 6 mm (1/4 inch) wide to allow for irregularities in mating surfaces and to provide for a full bedding and pointing joint.

b. Jointing mortar shall be left slightly recessed from the surface of the stonework or subsequently raked out, leaving a rebated joint.

c. Pointing shall be carried out using Haddonstone's color-matched dry mix in accordance with instructions printed on bags. Alternatively use the bedding mix, color matched to suit, in which case white cement may be necessary.

d. The joint between the capital stonework and the structure above shall be formed using a compressible filler or a weak mortar mix, to form a soft joint and ensure that any load is carried by the central structural core and not by the reconstructed stonework.

5. Infilling Techniques:

a. Hollow core of each column section shall be lined with polystyrene, Styrofoam, or similar, to act as an isolating medium when column cores are infilled with concrete.

b. This isolating medium shall accommodate possible differential movement between the stonework and concrete core.

c. The isolating material, when inserted, shall make continuous contact with the inner core surface. Provide sufficient overlap of material at both vertical and horizontal joints.

d. Concrete used to infill the cores shall ideally have rounded gravel aggregate of 10 mm maximum size.

e. Concrete shall be of medium to high workability to assist core filling while minimizing effort required during hand compaction.

f. Proprietary concrete plasticizing admixtures may be used where compatible with the concrete and approved by the manufacturer. All columns with shaft drum sections shall be concreted one section at a time. Subsequent concrete pours shall only take place after concrete in the preceding section has reached its initial set.

g. If the column is used to sleeve a structural steel member, the resultant void between the stone and steelwork may be left as a void or grouted. If grouting is carried out, incorporate an isolating medium adjacent to the stonework.

B. METAL TRELLIS

1. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit work to other construction; scribe and cope as needed for accurate fit.
2. Do not splice structural members between supports unless otherwise indicated.
3. Install aluminum components without visible distortion, with joints and connections aligned and securely fastened.
4. Protect powder-coated surfaces during installation. Do not drag components across finished surfaces.
5. Repair field-damaged coatings in accordance with coating manufacturer's written instructions.

C. METAL ARCHES

1. Install arches plumb, level, true to geometry, and securely anchored.
2. Verify anchorage before applying loads or attaching additional components.
3. Do not field-weld finished powder-coated components unless specifically approved.
4. Protect finished surfaces from mortar, grout, concrete, sealants, and other construction contaminants.

3.4 FIELD QUALITY CONTROL

A. Inspect installed trellis assemblies for alignment, plumb, level, dimensions, anchorage, connections, finish, and visible damage.

B. Verify cast stone joints are uniform, properly tooled, and free of cracks or open gaps.

C. Verify concrete infill is properly consolidated and that subsequent lifts are placed in accordance with specified sequencing.

D. Correct or replace components that do not comply with requirements.

E. Document field inspections and corrective work.

3.5 ADJUSTING AND REPAIR

A. Adjust assemblies so members are plumb, level, aligned, rigid, and free of visible distortion.

B. Repair minor finish damage using manufacturer-approved materials. Replace components where repair cannot produce an acceptable result.

C. Repair chipped or damaged cast stone only with manufacturer's approved repair materials and methods. Replace severely damaged units.

D. Do not conceal defective work with sealants, coatings, mortar, or other materials.

3.6 CLEANING AND PROTECTION

A. Clean completed trellis work using methods recommended by manufacturers of wood, cast stone, aluminum, and coatings.

B. Remove mortar, grout, concrete, dust, labels, protective films, and other construction residue without damaging finished surfaces.

C. Do not use acidic cleaners or abrasive methods on cast stone or powder-coated aluminum unless specifically approved by manufacturer.

D. Touch up, repair, or replace damaged products before Substantial Completion.

E. Protect completed trellis work from damage by subsequent construction operations until Substantial Completion.

F. At Substantial Completion, leave all assemblies clean, secure, properly aligned, and free of visible defects.

END OF SECTION 13 34 00

SECTION 13 3413.13
GREENHOUSES

PART 1 GENERAL

1.01 SUMMARY

A. Greenhouse: Design, provide and install a manufacturer-engineered, factory-fabricated greenhouse building, as shown on Drawings and as specified herein. Provide labor, materials, equipment, freight, and installation required for the greehouse structure and greenhouse equipment included in this Section.
   1. One freestanding 20-foot by 36-foot A-frame greenhouse.
   2. Complete greenhouse structural frame and associated bracing, connectors, fasteners, and anchorage to the prepared concrete foundation.
   3. Clear 8-mm twin-wall polycarbonate roof, sidewalls, and endwalls with manufacturer's standard glazing accessories.
   4. One double-swing personnel door and one single-swing personnel door, including frames, weatherstripping, and manufacturer's standard greenhouse door hardware.
   5. Motorized interior shade system, including fabric, drive motor, rack-and-pinion or manufacturer's standard drive components, supports, and hardware.
   6. Motorized rack-and-pinion wall vent.
   7. Mechanical ventilation system consisting of two nominal 24-inch exhaust fans, one nominal 16-inch upper-gable exhaust fan, and one motorized upper-gable inlet shutter, sized to coordinate with the ventilation system.
   8. Evaporative cooling pad system with pump, float valve, distribution components, and manufacturer-standard hardware.
   9. Two nominal 12-inch air-circulation fans.
   10. Two suspended natural-gas-fired unit heaters.
   11. Single-zone greenhouse environmental controller for heating and ventilation, including indoor temperature and humidity sensing.
   12. Thirteen (13) nominal 4-foot by 6-foot galvanized-steel greenhouse benches.
   13. Benchtop irrigation system including automated irrigation controller, manifold, distribution piping and fittings within the greenhouse.

B. Associated Work by General Contractor and other trades:
   1. Site preparation, grading, drainage, and erosion control.
   2. Concrete slab foundation.
   3. Non-structural brick veneer knee wall
   4. Flashing and counter-flashing between greenhouse construction and brick veneer or adjacent construction, except manufacturer's standard greenhouse glazing closures and trim.
   5. Building permits, permit fees, inspections, and testing required by the Authority Having Jurisdiction.
   6. MEP design, schematics, calculations, and stamped MEP drawings.
   7. Electrical power wiring, branch circuits, disconnects, grounding, low-voltage control wiring, and final electrical connections to greenhouse equipment.
   8. Natural gas piping, regulators, valves, and final gas connections to unit heaters.
   9. Water service to the greenhouse, final water connections to evaporative cooling and irrigation systems, backflow preventer, and pressure-regulating valve.
   10. Downspouts and connection of greenhouse drainage to site stormwater systems, unless specifically indicated otherwise.

C. Do not construct masonry or foundation work supporting or interfacing with the greenhouse until greenhouse shop drawings have been reviewed. Coordinate foundation and veneer dimensions with approved greenhouse shop drawings.

D. Greenhouse dimensions and equipment locations shown on Contract Drawings are diagrammatic. Final member sizes, component dimensions, and equipment locations may vary

to suit the selected manufacturer’s standard engineered system, subject to compliance with the overall design intent and approved shop drawings.

E. Items not specifically identified in this Section as Greenhouse Contractor work, and work assigned to another trade or Division, are by others.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for foundations, slabs, and equipment pads.

B. Section 04 0501 - Masonry Mortaring and Grouting: Non-structural brick veneer knee wall.

C. Section 04 2000 - Unit Masonry: Non-structural brick veneer knee wall.

D. Section 07 9200 - Joint Sealants: Sealing joints between greenhouse and adjacent construction.

E. Division 22 Plumbing: water service, backflow prevention, pressure regulation, and utility connections.

F. Division 23 HVAC: gas piping and code-required final connections/ start-up for fuel-fired equipment where applicable.

G. Division 26 Electrical: Power, control wiring, grounding, equipment connections, and controller mounting where indicated.

1.03 REFERENCE STANDARDS

A. Applicable building code and referenced structural standards adopted by the Authority Having Jurisdiction for the Project location.

B. Manufacturer’s published standards and installation instructions for greenhouse structure, glazing, and equipment.

C. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

F. AAMA/NSA 2100 - Specifications for Sunrooms; 2022 .

G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

H. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.

I. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

J. National Greenhouse Manufacturers Association (NGMA) - Standards for Design Loads in Greenhouse Structures, Ventilating and Cooling Greenhouses and Greenhouse Heat Loss Standards

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate greenhouse dimensions, anchor locations, foundation interface, masonry interface, equipment locations, and required utility rough-ins with the General Contractor and affected trades.

B. Sequence foundation and masonry work to follow review of greenhouse shop drawings.

C. Provide equipment electrical and utility information in time for coordination by MEP trades.

D. Preinstallation Meeting: Conduct preinstallation meeting one week prior to start of work of this section; require attendance by all affected installers.

1. Conduct meeting to verify greenhouse requirements, substrate conditions, utility connections, and manufacturer's installation instructions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer’s product information for greenhouse covering and greenhouse equipment furnished under this Section.

C. Greenhouse Shop Drawings: Submit project-specific plans, elevations, sections, dimensions, anchorage information, glazing details, door locations, equipment locations, and utility requirements necessary for coordination.
   1. Show foundation interface and required anchor locations. Foundation design and engineering are by others.
   2. Show greenhouse equipment loads and connection requirements for coordination by electrical, plumbing, and HVAC trades.

D. Structural Design Documents: Provide engineered greenhouse structural drawings signed and sealed by a Professional Engineer licensed in the State of Arkansas.
   1. Provide structural calculations only when required by the Authority Having Jurisdiction or requested as part of the permit review for the greenhouse structure.

E. Wiring Diagram: Provide greenhouse equipment/control wiring diagram for use by the electrical contractor.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Closeout Submittals: Provide available manufacturer operation, maintenance, and warranty information for greenhouse equipment furnished under this Section.

1.06 QUALITY ASSURANCE

A. Greenhouse Structural Design: Engineer greenhouse structural system for applicable code-required loads under the responsible charge of a Professional Engineer licensed in the State of Arkansas.

B. Manufacturer Qualifications: Manufacturer regularly engaged in manufacture of commercial greenhouse structures and equipment of the type specified, with at least ten years of documented experience.

C. Installer Qualifications: Installer experienced in installation of commercial greenhouse structures and equipment of the type specified, with at least ten years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle greenhouse materials and equipment in accordance with manufacturer recommendations and in a manner that prevents damage, deterioration, and loss.

B. Store materials off the ground and protect from weather and construction damage until installation.

C. Schedule delivery to minimize unnecessary long-term storage at the Project site.

1.08 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for additional warranty requirements.

B. Greenhouse Contractor: Provide standard one-year workmanship warranty from date of Substantial Completion for installation work performed under this Section.

C. Greenhouse covering, motors, pumps, controllers, fans, heaters, and other purchased components: Provide manufacturer’s standard warranties. Warranty duration and remedies are limited to the respective component manufacturer’s published warranty unless otherwise specifically stated in the Contract Documents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Greenhouse Contractor:
   1. Jackson Agrobuilders, LLC, Prairie Village, KS; www.jacksonagrobuilders.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Greenhouse structure and equipment manufacturers: Selected by Greenhouse Contractor from commercially available products meeting the requirements of this Section and the approved submittals. Specific equipment manufacturer names are not restricted by this Section.

2.02 GREENHOUSE CONFIGURATION

A. Installation: Free-standing greenhouse on new concrete foundation/slab prepared by General Contractor and other trades.

B. Greenhouse:
   1. Overall Nominal Size: 20-foot wide by 36-foot long, measured generally center-to-center of greenhouse columns.
   2. Roof Shape: A-frame/ gable, straight eave.
      a. Roof Slope: As indicated on drawings.
   3. Sidewall height: Nominal 10 feet from column base to eave
   4. Bay spacing: Three nominal 12-foot bays along the 36-foot length, subject to selected manufacturer’s standard system
   5. Primary columns: Nominal 4-inch by 4-inch square structural columns, 8-gauge or manufacturer’s engineered equivalent providing equal or greater code-required structural capacity.
   6. Column anchorage: Base-plated to prepared concrete foundation/slab in accordance with approved greenhouse structural drawings.
   7. Non-structural brick veneer/knee wall: Approximately 30 inches high where shown; by others. Greenhouse framing and glazing shall coordinate with veneer elevation.
   8. Layout and final dimensions: As indicated on approved greenhouse shop drawings.

2.03 DESIGN CRITERIA

A. Design greenhouse structural framing and anchorage to resist loads required by the applicable building code for the Project location.

B. Transfer greenhouse structural loads to the foundation at locations shown on approved structural shop drawings. Foundation structural design is by others.

C. Use manufacturer’s standard engineered greenhouse members and connections. Curtain-wall, storefront, window-wall, and residential sunroom performance testing criteria are not required unless specifically required by the applicable code for the greenhouse system provided

2.04 COMPONENTS

A. Framing System: Manufacturer's standard commercial greenhouse framing system using galvanized steel, aluminum, or a combination thereof as required by the engineered system.
   1. Provide primary and secondary structural members, bracing, clips, plates, fasteners, and accessories required for a complete greenhouse frame.
   2. Member thicknesses, connection details, and reinforcing shall be determined by the greenhouse structural design.

B. Glazing Systems: Manufacturer's standard.clear UV-protected 8-mm twinwall polycarbonate panels.
   1. Applications: Roof, sidewalls, and endwalls above the masonry/veneer base where shown.
   2. Provide manufacturer's standard profiles, caps, closures, gaskets, tapes, sealants, and fasteners required for the selected polycarbonate glazing system.
   3. Install glazing to accommodate normal thermal movement and to provide weather resistance consistent with standard commercial greenhouse construction.

C. Flashings and Closures: Manufacturer's standard for specified system.

D. Doors: Personnel doors, with frames compatible with, and integrated into glazed structure framing system.
   1. One (1) pair polycarbonate/glazed greenhouse personnel doors with aluminum or corrosion-resistant frame, weatherstripping, and standard hardware.
   2. One (1) single polycarbonate/glazed greenhouse personnel door with aluminum or corrosion-resistant frame, weatherstripping, and standard hardware.
   3. Door sizes and handing: As indicated on Drawings and approved shop drawings.
   4. Specialized access-control hardware, removable/interchangeable cores, panic devices, electronic strikes, card readers, operators, and specialty welded frames are not included unless specifically shown and scheduled.

2.05 GREENHOUSE EQUIPMENT

A. Greenhouse Equipment, General: Provide the following greenhouse furnishings, equipment, and amenities to provide a complete turn-key horticultural building project:

B. Ventilation System:
   1. Exhaust Fans: Two (2) nominal 24-inch, single-speed, single-phase exhaust fans. Provide safety guards, shutters where integral to the selected equipment, and manufacturer-standard belt tensioning or drive components. Fan capacity shall be approximately 4,500 to 5,000 cfm each at 0.10 inch static pressure, or equivalent performance suitable for the greenhouse.
   2. Upper-Gable Exhaust Fan: One (1) nominal 16-inch, single-speed, single-phase exhaust fan with safety guarding and manufacturer-standard shutter/drive components. Fan capacity shall be approximately 2,000 to 2,500 cfm at 0.10 inch static pressure, or equivalent performance.
   3. Upper-Gable Inlet Shutter: One (1) nominal 16-inch motorized aluminum inlet shutter, single-phase, sized to coordinate with the ventilation system.
   4. Motorized Wall Vent: One (1) exterior motorized wall vent, nominal 3 feet high by 18 feet long, with rack-and-pinion drive and motor. Final framing shall suit the selected greenhouse system and approved shop drawings.

C. Evaporative Cooling System:
   1. Provide one (1) self-supporting evaporative cooling pad wall, nominal 3 feet high by 18 feet long by 4 inches thick, with recirculating water system and manufacturer-standard supports and hardware.
   2. Include recirculating/submersible pump, float valve, distribution header, collection components, internal piping, mounting supports, and manufacturer-standard hardware required for operation of the cooling pad system.
   3. An exterior remote reservoir tank is not required where the selected system incorporates a self-contained collection/reservoir arrangement.
   4. Incoming water service, backflow prevention, pressure regulation, and final water connection are by others.

D. Air Circulation: Provide two (2) nominal 12-inch recirculation fans suitable for greenhouse service.

E. Unit Heaters:
   1. Provide two (2) suspended natural-gas-fired unit heaters, each with nominal input capacity of 45,000 Btu/h.
   2. Provide manufacturer-standard heater hanging/support kits and vent/stack components required to route combustion venting through the greenhouse endwall. Roof penetrations are not intended.
   3. Gas piping, gas regulators, final gas connections, electrical connections, and licensed trade start-up are by others.

F. Shade System:
   1. Provide one (1) motorized shade system sized for the 20 foot by 36 foot greenhouse and configured to follow the roof slope/flat/slope geometry of the structure.

2. Provide approximately 50 percent shade fabric suitable for greenhouse use, support lines, drive motor, rack-and-pinion or manufacturer-standard drive mechanism, and associated hardware.

G. Environmental Controls:
   1. Provide one (1) single-zone greenhouse environmental controller with indoor temperature and relative-humidity sensor.
   2. Controller shall provide automatic control of greenhouse heating and ventilation equipment furnished under this Section. Provide controller outputs/contact interface as required for the selected greenhouse equipment.
   3. Provide equipment/control wiring diagram. Line-voltage wiring, low-voltage field control wiring, mounting of controller/motor-control panels, grounding, and final electrical connections are by the electrical contractor unless specifically indicated otherwise.

H. Greenhouse Benches: Provide thirteen (13) nominal 4 foot by 6 foot benches with galvanized-steel frames and durable corrosion-resistant open bench tops suitable for horticultural use.

I. Benchtop Irrigation System:
   1. Provide greenhouse benchtop irrigation distribution system, automated irrigation controller, manifold, valves and fittings required to distribute water to the benches.
   2. Incoming water supply to greenhouse shall be 1-inch nominal service capable of approximately 50 psi at the greenhouse unless otherwise coordinated.
   3. Backflow preventer, pressure-regulating valve, and connection of building water supply to the greenhouse irrigation system are by others.

2.06 MASONRY VENEER MATERIALS

A. Brick Units: Facing brick; comply with requirements in Section 04 2000.

B. Mortar and Grout: As specified in Section 04 0511.

C. Reinforcement and Anchorage: As specified in Section 04 2000.

PART 3EXECUTION

3.01 PREPARATION

A. Inspect work related and/or adjacent to greenhouse construction.

B. Do not begin installation until substrates have been properly prepared in compliance with drawings and approved by glazed structure manufacturer.

C. Notify Architect of unsatisfactory preparation conditions and do not begin work until they have been rectified.

D. Thoroughly clean surfaces and substrates prior to installation.
   1. Prepare surfaces using method recommended by manufacturer for achieving best result for substrate under project conditions.

E. Start of installation constitutes acceptance of project conditions.

F. Greenhouse Contractor is responsible for all unloading of greenhouse materials, systems, equipment and to provide any lift or installation equipment required.

3.02 GREENHOUSE ERECTION

A. Install in accordance with shop drawings and manufacturer’s instruction and installation manual(s).

B. Maintain dimensional tolerances and alignment with adjacent work.

C. Anchor securely in place, allowing for required movement, including expansion and contraction.
   1. Drilling and setting of anchor bolts is to be by Greenhouse Manufacture

D. Dissimilar Metals: Separate aluminum from cementitious material with polyurethane or asphaltic coating.

3.03 UTILITY CONNECTIONS AND START-UP

A. Electrical: By electrical contractor. Provide branch wiring, disconnects, line-voltage and low-voltage control wiring, grounding, controller/motor-control mounting, and final connections required for greenhouse equipment. Greenhouse Contractor shall provide available equipment wiring diagrams.

B. Water: By plumbing/General Contractor. Extend water service to the greenhouse and make final connections to evaporative cooling and irrigation systems. Provide backflow prevention and pressure regulation. Coordinate nominal 1-inch service at approximately 50 psi unless otherwise approved.

C. Gas: By HVAC/plumbing trade. Provide gas piping, regulators, valves, and final gas connections to unit heaters.

D. Start-up of fuel-fired and electrically powered equipment requiring licensed trade start-up shall be performed by the applicable licensed electrician or HVAC technician.

E. Complete final utility connections promptly after greenhouse installation to avoid prolonged exposure of uncommissioned equipment to greenhouse environmental conditions.

3.04 MASONRY INSTALLATION

A. After the Greenhouse Manufacturer has completed the structural framing, General Contractor/other Trades to install brick masonry veneer knee wall, including sheet metal flashings.

B. Coordinate with greenhouse contractor and install per approved shop drawings and requirements in Division 4 Masonry Sections.

3.05 ADJUSTING AND CLEANING

A. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work

B. Adjust doors, vents, shade drive, fans, and other operable greenhouse components for smooth operation.

C. Remove temporary coverings and construction debris resulting from greenhouse Work.

D. Clean surfaces soiled by greenhouse installation using methods recommended by the applicable product manufacturer. Final cleaning of glazing beyond construction-related soiling is by General Contractor unless otherwise agreed.

E. Replace or repair greenhouse components damaged during installation.

3.06 TRAINING

A. Greenhouse Manufacturer or approved representative shall provide on-site training to Owner personnel on the use and operation of greenhouse systems and equipment.

3.07 PROTECTION

A. Protect installed greenhouse structure, glazing, and equipment from damage through completion of Project.

B. Touch up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 13 3413
GLAZED STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install manufacturer-engineered, factory-fabricated aluminum-framed glazed structure, as shown on Drawings and in accordance with these specifications. The work to be performed shall include all labor, materials, equipment and transportation for erecting the structure and components. The Glazed Structure Manufacturer shall provide and mount or assemble the building including, but not limited to, the following:
   1. Aluminum framing.
   2. Accessories and equipment.
   3. Glazing and gaskets.
   4. Insulated metal roof panels.
   5. Sealants, caulking and joint fillers.
   6. Associated flashings.

B. Associated Work to be provided by General Contractor and other Trades:
   1. Site preparation.
   2. Basement and foundation construction.
   3. Exterior brick masonry base.
   4. Flashings and sealants associated with connection of glazed structure to remainder of structure.
   5. Interior finish flooring and ceiling components.
   6. Interior and exterior lighting
   7. Mechanical, electrical, plumbing and fire protection systems.
   8. Motorized shades and devices.
   9. Protection materials or coverings to protect structure from other Trades following erection.

C. It is not the intent of this portion of the specifications to cover concrete, grouting, masonry work, mechanical plumbing and electrical work, utility connections, final cleaning of glazing, nor counter-flashing. This portion shall be the responsibility of the General Contractor or his selected Subcontractors other than the Glazed Structure Manufacturer.

D. No masonry or foundation installation supporting the glazed structure shall be made prior to approval of shop drawings. Approved shop drawings shall be used to make all masonry and foundation installations. Dimensions may vary slightly from contract drawings to accommodate manufacturer's standard, but total area shall not be less than 98% of that shown.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete for foundations, slabs, and walls.

B. Section 07 2100 - Thermal Insulation: For additional rigid insulation to be installed below pre-manufactured roof system.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Base and sill flashing installation.

D. Section 07 9200 - Joint Sealants: Sealing joints between glazed structures and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 501.1 - Standard Test Method for Exterior Windows, Curtain Walls and Doors for Water Penetration Using Dynamic Pressure; 2005.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

E. AAMA/NSA 2100 - Specifications for Sunrooms; 2022 .

F. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

I. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.

J. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

K. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

L. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014.

M. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2014.

N. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

O. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

P. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

R. GANA (GM) - GANA Glazing Manual; 2009.

S. ICC (IRC) - International Residential Code for One- and Two-Family Dwellings; 2012.

T. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

U. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

V. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of glazed structure with size, location, and installation of foundations and service utilities.
   1. Cooperate with regulatory agency or authority and provide data as requested.

B. Coordinate the Work of other trades following installation of glazed structure to complete additional scopes of work; see Drawings.

C. Preinstallation Meeting: Conduct preinstallation meeting one week prior to start of work of this section; require attendance by every affected installer.

D. Sequencing: Ensure that utility connections are achieved in orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer’s data sheets for each product to be used.

C. Shop Drawings: Include project-specific information not fully detailed in manufacturer’s standard product data, including, but not limited to plans, elevations, and details.

1. Indicate adjacent construction, opening dimensions, tolerances, profiles, product components, anchorages, and accessories.
2. Indicate fastener locations, glazing, and hardware arrangements.
3. Include schedule identifying each unit, with marks or numbers referencing drawings.

D. Samples:
1. Custom Metal Finish: Two samples each for interior and exterior framing color verification; colors to be selected by Architect.
a. Minimum Sample Size: 6 inches by 6 inches.
2. Glazing: Two samples of each type.
a. Minimum Sample Size: 12 inches by 12 inches.
3. Coordinate with Section 08 8000 - Glazing..

E. Design Documents:
1. Comply with applicable code for submission of design calculations required by authority having jurisdiction for securing permits.
2. Approval submittals shall include engineered stamped drawings and a full set of engineering calculations, signed and sealed by a structural engineer licensed to practice in the State of Arkansas.

F. Manufacturer's Instructions:
1. Storage and handling requirements and recommendations.
2. Preparation instructions and recommendations.
3. Installation methods.

G. Designer's qualification statement.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

J. Testing agency's qualification statement.

K. Field testing report.

L. Specimen warranty.

M. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Source Requirements: Entire glazed structure shall be the product of a single manufacturer.

B. Designer Qualifications: Perform structural design under direct supervision of Professional Engineer experienced in design of this type of work and licensed in the State of Arkansas.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least ten years of documented experience.

D. Installer Qualifications: Company specializing in performing work of type specified and with at least ten years of documented experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in manufacturer's original packaging with manufacturer's name and product identification intact and legible.

B. Inspect and report any freight damages immediately to the Glazed Structure Manufacturer.

C. Take extra precautions when unloading and storing materials to protect all prefinished surfaces and all glazing materials.

D. Store products above ground, in manufacturer’s original unopened packaging, covered to protect from weather, damage, precipitation, and construction dirt until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimal installation results.

B. Do not install products under environmental conditions outside manufacturer’s absolute limits.

C. Do not perform structural silicone sealant work when ambient air temperature is below 10 degrees F.

1.09 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS for additional warranty requirements.

B. Provide complete manufacturer's limited warranty agreement for the following components:
   1. Structural Aluminum Frame:
      a. Limited warranty against manufactured defects, provide warranty of ten years.
      b. Lifetime warranty on aluminum members against rust.
   2. Aluminum Framing Finishes. Provide framing system manufacturer's standard warranty for finish type selected.
      a. For stock color AAMA 2605 finishes, provide organic coating manufacturer’s warranty for color and film integrity for minimum of 20 years from date of application.
      b. For custom color AAMA 2605 finishes, provide organic coating manufacturer’s warranty for color and film integrity for minimum of 20 years from date of application.
   3. Glazing: Provide glazing manufacturer’s standard warranty against defective materials, delamination, seal failure, and other defects in manufacturing.
      a. Insulating Glass Units: Provide 10 year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design: Crystal Structures, Commercial Division of Sunshine Rooms, Inc., 3333 North Mead, Wichita, KS 67219; (800) 222-1598; www.sunshinerooms.com.
   1. Contact: Gus Frey, National Sales Manager; tel. (316) 838-0829; mobile (316) 201-8655; email: gfrey@csglazing.net.
   2. Contact: Josh Sucher, Director Sloped Glazing Division; tel. (316) 838-0049; mobile (316) 347-1766; jsucher@csglazing.net.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GLAZED STRUCTURE APPLICATIONS

A. Installation: Attached to side of new structure as extension..
   1. Foundation Condition: New concrete foundation wall. See Drawings.

B. Commercial Sunroom, Solarium, or Conservatory: Installations not subject to ICC (IRC).
   1. Roof Shape: Compound, straight eave, bays as indicated on drawings.
      a. Roof Slope: As indicated on drawings.
      b. Conservatory Roof Configuration: As indicated on drawings.
   2. Framing: Coated aluminum.
   3. Wall System: Coated aluminum framing with glazing type IG-1 - insulating glass units.
   4. Roof System: Coated aluminum framing with type MP-1 - Insulated metal panels.
   5. Layout and Dimensions: As indicated on drawings.

2.03 DESIGN CRITERIA

A. Design structural framing that is capable of transferring moments and forces into foundations. Framing members to be considered include rafters, purlins, and vertical mullions. Use design loads stipulated by applicable building code requirements.

B. Perform work in accordance with AAMA/NSA 2100.

2.04 PERFORMANCE CRITERIA

A. Commercial Conservatory Glazing:
   1. Perform glazing in accordance with GANA (GM) for glazing installation methods.
   2. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated, determined with the following procedures and/or test methods:
      a. Center of Glass U-Factor: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
      b. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
      c. Solar Optical Properties: Comply with NFRC 300 test method.
   3. Air and Water Leakage: Leakage measured at differential test pressure amounting to 20 percent of specified strength performance pressure required with operable windows, doors, or joints (if any) sealed during testing procedure.
      a. Air Leakage: Not to exceed 0.18 cfm/sq ft of glazed enclosure, when tested in accordance with ASTM E283/E283M.
      b. Water Leakage: None, when measured in accordance with AAMA 501.1 with test pressure difference of 2.86 psf.
   4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
   5. Structural Performance: No glazing material breakage or permanent damage to fasteners, anchors, hardware, or actuating mechanisms, when tested in accordance with ASTM E330/E330M.
      a. Maximum Allowable Deflection: All load bearing members under any design load combination (including dead load) shall not exceed L/180 of its clear span.
      b. Seismic Design: Per International Building Code (IBC) 2021.
         1) Risk Category: II
         2) Site Class: C
         3) Seismic Design Category: B
         4) Analysis Procedure: Equivalent Lateral Force Procedure (ELFP)
      c. Wind Loads: Test in accordance with ASTM E330/E330M, using loads 1.5 times specified design pressures and 10 second duration of maximum load.
         1) Design Ultimate Wind Speed: 107 mph
         2) Risk Category: II
         3) Exposure Category: C
         4) Internal Pressure Coefficients: CGpi = +/- 0.18
         5) Velocity Pressure: Qh = 23.9 psf
         6) Components and Cladding Design Wind Pressures:

ROOF UPLIFT

Zone	Gross Uplift (pdf)
1	-30.6
2	-33.0
3	-52.2

(a) Net uplift does not include self-weight of joists.
(b) Reference ASCE 7 for specific zone locations and extents.
(c) Reliable roof dead load: DL = 10 psf (to be used for roof wind uplift calculations only.
(d) Based on effective area of 100 sf.

WALL PRESSURES

Zone	Net Pressure (psf)
4	-26.4
5	-29.4

      d. Design Pressure (DP): In accordance with applicable codes.

e. Normal Wall Deflection Limit: Not to exceed 1/175 of clear span for span lengths of 13 feet 6 inches or less and 1/240 plus 1/4 inch for others.
f. Snow Load: 15.0 psf (ASCE 7)
    1) Exposure Coefficient: Ce = 1.2.
    2) Thermal Factor: Ct = 1.0
    3) Importance Factor for Snow: I = 1.0
    4) Roof Slope Factor = Cs = 1.0
g. Provide a pre-engineered weepage system that collects condensation and directs it to the exterior of the glazed structure.
h. Aluminum framing system shall be thermally broken.

2.05 COMPONENTS

A. Framing System: Manufacturer's standard for indicated roof shape and bay width, using coated aluminum for primary and secondary structural members.
    1. Thickness of framing members based on design loading, cross sectional configuration, and fabrication requirement.
    2. Use extrusions with integral condensation collection and guttering system thermally separated from exterior pressure bar.

B. Multiple-Bay Structure: Construct multiple-bays using selected roof and endwall framing system. Join bays with gutter-connect system of posts connected by trusses, gutters with saddle supports, gutter extensions, and downspouts.

C. Glazing Systems: Pressure glazing bar system.
    1. Comply with requirements in Section 08 8000 - Glazing.
    2. Roof Panels: Aluminum insulating roof panels with sealed edges.
        a. Type MP-1 - Insulating Roof Panel, manufacturer's standard.
            1) Applications: Use at sloped roofs.
            2) Width: Nominal 1-inch.
            3) Exterior face: 0.024" smooth coated aluminum.
                (a) Finish: Custom color; same as framing exterior.
            4) Interior face: 0.024" smooth coated aluminum.
                (a) Finish: Custom color; same as framing interior.
            5) Insulation: high-density polyisocyanurate (interior and exterior) with expanded poystyrene foam insulation between.
        b. Products:
            1) Citadel Architectural Products, Inc.; GlazeGuard 1000; R value = 6.0.
            2) Substitutions: See Section 01 6000 - Product Requirements.
    3. Double Glazing: Double-pane glass units with sealed edges.
        a. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
            1) Applications: Use at sidewalls and endwalls.

D. Flashings and Closures: Manufacturer's standard for specified system.

E. Snap-on Covers and Miscellaneous Nonstructural Trim: Manufacturer's standard items for specified system.

F. Glazing Accessories: Manufacturer's standard, of type indicated on drawings.
    1. Decorative Mullions: Manufacturer's standard.
    2. Muntin Grids: Manufacturer's standard.

G. Decorative Enclosure Accessories: Manufacturer's standard, of type indicated on drawings.

2.06 MATERIALS

A. Aluminum Extrusions: Alloy and temper 6063-T5, 6063-T6, or 6061-T6 members complying with ASTM B221 (ASTM B221M), with minimum thickness 1/8 inch for structural members and 1/16 inch for nonstructural members.

B. Formed Aluminum: Sheet material of alloy 5052, 5005, or 6061-T651 members complying with ASTM B209/B209M, with minimum thickness 1/8 inch for structural members and 1/16 inch for nonstructural members.

C. Internal Reinforcing for Aluminum Framing Members:
   1. Structural Aluminum: ASTM B308/B308M, 6061-T6.
   2. Shapes and sizes based on structural calculations to suit installation.
   3. Bolt-on beams or other mechanical enhancements will not be allowed.

D. Rigid Board Insulation: Expanded polystyrene; flame spread/smoke developed index of 25 or less (flame) / 450 or less (smoke) , when tested in accordance with ASTM E84.
   1. Thermal Conductivity (k factor): 0.030 when tested in accordance with ASTM C177.

E. Glazing Gaskets: Compression-type design, replaceable, EPDM, complying with ASTM C864 requirements.
   1. Gaskets to be multi-finned style designed to reduce water penetration.
   2. Shore-A Hardness: 60-70 Durometer.
   3. Compatible with glazing sealant.
   4. Profile and hardness as required to maintain uniform pressure for watertight seal.
   5. Color: Black.

F. Flashings: Metal and finish matching system framing components, with thickness as recommended by manufacturer for conditions encountered.
   1. Pan flashings to be a minimum of 0.04” thick and shall be in the same finish as the frame.
   2. Exterior flashings in excess of 6” wide will be increased to a minimum thickness of 0.063” and in the same finish as the frame.
   3. Secured using concealed fastening method.

G. Glazing Setting Blocks, Edge Blocks, and Spacers: Manufacturer's standard flexible PVC, compatible with glazing type.

H. Glazing Tape: Closed cell, PVC foam with double-sided acrylic adhesive; manufacturer's standard.

I. Anchors and Fasteners: Recommended by manufacturer.
   1. All connections shall be made with stainless steel of type which will not cause electrolytic action or corrosion.
   2. Anchor bolts shall be stainless steel and shall be identified in detail in the Shop Drawings and engineering reports. **Anchor bolts shall not penetrate the sub-sill flashing provided by the manufacturer.**
   3. Exposed fasteners should be avoided wherever possible; if necessary they shall be painted to match the system’s frame.
      a. Finish exposed fasteners to match aluminum frame.

J. Sealants: Comply with requirements in Section 07 9200 and the following:
   1. Within glazing area: Silicone sealant, ASTM C920 .
      a. Color:
         1) Metal-to-glass joints: Black to match gaskets.
         2) Metal-to-metal joints: Match frame color where possible.
   2. Connection joint to remainder of building: Structural silicone sealant, ASTM C1184 .
      a. Color: Black.
      b. Products:
         1) Momentive Performance Materials; SilPruf SCS2000.
         2) Substitutions: See Section 01 6000 - Product Requirements.

2.07 FABRICATION

A. All fabrication shall be done according to the final set of approved shop drawings. Approved shop drawings shall supersede all previous blueprints or documents.

B. Perform major fabrication tasks at manufacturing location and not on site.

C. Manufacturer must be notified prior to any field fabrication or modifications.

D. Remove burrs and rough edges on metal items prior to finish application.

E. Install gaskets and glazing tapes at factory to greatest extent possible.

F. Disassemble glazed structure only to extent necessary due to shipping and handling limitations.

G. Weld aluminum members in accordance with AWS D1.2/D1.2M. All welding will comply with the recommendations set forth by the American Welding Society.

H. All interior horizontal aluminum members shall utilize poured and de-bridged thermal barrier technology using polyurethane as the thermal barrier.

I. Exterior horizontal mullion assemblies shall not extend higher than 1/8” above the glazing.

J. Internal structural stiffeners: In an effort to meet higher design loads, internal stiffeners will be allowed, provided they have been pre-engineered and installed within the interior of the main rafters. Internal stiffeners shall be aluminum and the alloy shall be 6061-T6. **"Bolt-on" beams or other mechanical enhancements will not be allowed.**

K. Exterior “snap-on” bar cap covers shall cover the entire surface of the bar cap without seams, fasteners or joints. Exposed exterior fasteners are unacceptable.

L. Use isolation membrane materials to separate dissimilar metals to prevent galvanic corrosion/action between materials.

M. Rigidly fit and secure joints and corners of extruded framing members with screw and spline; fabricate rigid joints with connections that are flush, hairline, and weather resistant.

N. Fabricate components to allow for expansion and contraction with minimum clearance and shim spacing around perimeter of assembly.

O. Drain to exterior any water entering exterior joints, condensation occurring in glazing channels, or migrating moisture occurring within system.

P. Frame system shall incorporate a pre-engineered weepage system that is capable of collecting moisture and forcing it to the exterior of the glazed structure.

Q. Prepare components to receive concealed anchorage devices, and ensure that fasteners will be concealed upon completion of installation.

R. Primary vertical aluminum members shall have a built-in “accessory track” capable of accepting machine screws without drilling holes into the aluminum for the hanging and relocating of accessories.

S. Primary vertical aluminum members shall incorporate built-in shade tracks that will allow the installation of a shade system without drilling holes into the aluminum and adding mounting hardware.

T. Adhere glass to glazing frames with structural adhesive and cure under controlled conditions in shop. Field glazing of frames to glass is not acceptable.

2.08 FINISHES

A. Aluminum Finishes: All visible aluminum extrusions will be finished utilizing the following two-tone paint scheme.

1. Exterior Finish: Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
    a. All visible aluminum extrusions shall have a factory applied, baked-on, 70% PVDF fluoropolymer resin based coating (Fluropon or Fluropon Classic II) as manufactured by the Valspar Corp.
    b. Type: Fluropon three-coat (20 year warranty).
    c. Color: Custom color to be selected by architect.
2. Interior Finish: Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.

a. All visible aluminum extrusions shall have a factory applied, baked-on, 70% PVDF fluoropolymer resin based coating, Kynar 500.
b. Type: Kynar PVDF two-coat (20 year warranty)
c. Color: Custom color to be selected by architect.

2.09 ACCESSORIES

A. Felt Backing Tape: Separation and cushioning white strip.
1. Width: 1-1/2 inches.

PART 3EXECUTION

3.01 PREPARATION

A. Site preparation shall be in accordance with approved Shop Drawings. Related site work must be level, square, and plumb. All dimensions must be according to the final shop drawings.

B. Structure contractor shall direct, supervise, and inspect all site work related to the structure.

C. Inspect work related and/or adjacent to glazed structure construction. Structure contractor shall examine surrounding structure and the conditions under which the work is to be performed, and notify the general contractor and architect in writing of any conditions detrimental to the proper and timely completion of the job

D. Do not begin installation until substrates have been properly prepared in compliance with drawings and approved by glazed structure manufacturer.

E. Notify Architect of unsatisfactory preparation conditions and do not begin work until they have been rectified.

F. Thoroughly clean surfaces and substrates prior to installation.
1. Prepare surfaces using method recommended by manufacturer for achieving best result for substrate under project conditions.

G. Start of installation constitutes acceptance of project conditions.

H. Structure contractor to supply all labor necessary to unload all of its materials from delivery trucks.

I. Structure contractor to coordinate with General Contractor regarding lifting structure components to desired working and installation heights, and negotiate associated lifting costs.

J. Structure contractor shall deliver all related operating instructions, maintenance manuals and warranty registration cards to the General Contractor prior to the completion of the project.

3.02 GLAZED STRUCTURE AND ENVELOPE INSTALLATION

A. Install in accordance with approved shop drawings and manufacturer’s instruction and installation manual(s).

B. Separate dissimilar materials using nonconductive tape, paint, or other material not visible in finished work.

C. Provide attachments and shims to permanently fasten system to building structure.

D. Maintain dimensional tolerances and alignment with adjacent work.

E. Anchor securely in place, allowing for required movement, including expansion and contraction.

F. Install glazing sealants, including surface preparation in accordance with manufacturer’s instructions and best industry practices.

G. Install base flashings in accordance with Section 07 6200.

H. Set sill members in bed of sealant. Set other members with internal sealants to provide weather tight construction.

I. Install flashings, bent metal closures, corners, gutters, and other accessories as required or detailed.

J. Clean surfaces and install weather-barrier sealants in accordance with sealant manufacturer's instructions and guidelines.

K. Touch up damaged finishes so repair is imperceptible from distance of 3 feet, and remove and replace components that cannot be acceptably touched up.

3.03 TOLERANCES

A. Maximum Variation from Plumb, Level, or Line: 1/8 inch per 10 feet, or 3/8 inch total in overall dimension.

B. Alignment of Two Adjoining Members Abutting in Plane: Within 1/16 inches.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for testing and inspection.

B. Test installed glazed structure for water leakage in accordance with AAMA 501.2.

3.05 CLEANING

A. During progress of the work, remove from project site all discarded materials, rubbish, and debris resulting from the work.

B. Remove temporary coverings and means of protection of adjacent work areas.

C. Upon completion, clean all surfaces which have become soiled or coated as a result of work of this section, using proper methods which will not scratch or otherwise damage finished surfaces. Use only products and techniques acceptable to manufacturer of products being cleaned.

D. Repair or replace damaged installed products.

E. Clean abraded finish surfaces and touch up with air dry paint, using means and methods approved and furnished by manufacturer, in color matching factory-applied finishes.

F. Remove from project site, and legally dispose of, construction debris associated with this work.

G. Final cleaning of glazing shall be the responsibility of the General Contractors, or selected Subcontractors other than the Structure Contractor.

3.06 PROTECTION

A. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

B. Protect installed products until completion of project.

END OF SECTION

SECTION 13 3423
FABRICATED STRUCTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufacturer-engineered, factory-fabricated storage building ("Garden Shed").

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete pad, foundations and anchor bolts.

B. Division 26: Electrical power service and wiring connections.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of greenhouse with size, location, and installation of foundations and service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of this work; require attendance by all affected installers.
   1. Conduct meeting to verify storage building requirements, substrate conditions, utility connections, and manufacturer's installation instructions.

C. Sequencing: Ensure that utility connections are achieved in orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions, dimensions and profiles of components and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Submit plans, elevations, sections, construction details, and utility connections as necessary for this work.
   1. Include design engineer's stamp or seal on each sheet of shop drawings.

D. Samples: Submit two samples of specified finished products, illustrating color and texture of finish.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging and store until ready for installation.

B. Protect components and accessories from corrosion, deformation, damage and deterioration when stored at job site. Keep materials free from dirt and foreign matter.

1.07 WARRANTY

A. See Section 01 7800 - CLOSEOUT SUBMITTALS, for additional warranty requirements.

B. Manufacturer Warranty: Provide 7- year manufacturer warranty for fabricated structures that fail in materials or workmanship within warranty period as indicated .

C. Materials Warranty: Provide 1-year additional warranty form manufacturer for fabricated structure materials, including the following additional individual product warranties:
   1. Tamko Heritage 30-year Shingles: 30-year limited warranty; 15-year full start protection period; 15-year limited warranty against wind up to 110 mph.
   2. LP SmartSide Siding: 50-year limited warranty.

3. Valspar Duramax Premium Coatings: Limited lifetime warranty.
4. Advantech Flooring: Limited lifetime warranty.
5. Pressure-treated Lumber: 20-year limited lifetime warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Fabricated Storage Building:
   1. Holden Buildings; www.holdenbuildings.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MANUFACTURED UNITS

A. Type of Application: Storage.
   1. Style: Utility Side Door; As indicated on drawings.
   2. Size: As indicated on drawings.
   3. Material: Wood.
   4. Siding: LP Smart Side
      a. Siding color: To be selected from manufacturer's full range.
      b. Contrasting trim color: To be selected from manufacturer's full range.
   5. Roofing: Architectural shingles.
      a. Color: To be selected from manufacturer's full range.
   6. Doors: As indicated on Drawings.
      a. Pair doors: Shop-built double door, manufacturer's standard.
      b. Single door: 36-inch pre-hung 1/2-lite (inswing), manufacturer's standard.
   7. Windows: As indicated on Drawings.
      a. 2-ft by 3-ft single hung window, manufacturer's standard.
   8. Floor joists: 2x6's at 12-inches on center.
   9. Flooring: AdvanTech or LP Legacy, 1 1/8-inch tongue-and-groove
   10. Interior Furnishings: As shown on Drawings
      a. Work bench, manufacturer's standard.
      b. 3-Tier standard shelving units, manufacturer's standard
   11. Include manufacturer's standard electrical package: 100-amp breaker box, 3 light sockets and 4 plugs.

2.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide factory fabricated structures capable of withstanding the following loads and stresses without damage or failure.
   1. Loads: In compliance with local building codes.

B. Thermal Movement: Design control booth to accommodate thermal movement caused by ambient temperature range of 120 degrees F and surface temperature range of 180 degrees F without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects on assembly components.

C. Electrical Components, Devices, and Accessories: Listed and labeled by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction and installed in compliance with NFPA 70, and marked for intended application.

2.04 OTHER COMPONENTS

A. Lighting Fixtures: Provide interior and exterior lighting fixtures as shown on Drawings.

B. Interior Wall Finish: Provide tool pegboard panels and fasteners.
   1. Lowe's Hardboard Pegboard panels or similar.

C. Electric Power Service: As shown on Drawings.

2.05 FABRICATION

A. Fabricate structure completely in factory, including but not limited to the following:
   1. Glazing of windows and doors.

2. Wiring of electrical systems, made ready for on-site service connection.

B. Fabricate structure for forklift unloading by providing forklift pockets in base that are suitable for placement of structure on prepared foundations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, adjacent areas and conditions, and supporting foundation, with installer present, for compliance with manufacturer's requirements, including installation tolerances and other conditions affecting performance of this work.

B. Examine installed anchor bolts for accuracy, and verify that bearing surfaces are ready to receive this work.

C. Examine rough-in of required electrical services prior to placement of structure.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean areas of supporting foundation thoroughly prior to installation.

B. Prepare substrate surfaces using methods as recommended by manufacturer under project conditions.

3.03 INSTALLATION

A. Install structure in accordance with manufacturer's written instructions.

B. Set structure plumb and aligned, baseplates level and true to plane with full bearing on concrete substrate, and securely fasten to concrete base with indicated anchorage. See Section 03 3000.

C. Install connection to electrical systems.

D. Install manufacturer-provided furnishings as required.

E. Install specified interior finish pegboards.

F. Install light fixtures and complete electrical installation.

G. Touch-up painting where required.

3.04 ADJUSTING

A. Adjust doors, operable windows, and hardware to operate smoothly and properly without binding, and verify that locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving booth components in accordance with manufacturer's written instructions.

C. Touch-up, repair or replace damaged products or exposed finishes prior to Date of Substantial Completion.

3.05 CLEANING

A. Clean structure in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 21 0000
SUPPLEMENTARY FIRE SUPRESSION GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes supplementary general requirements for the following:
   1. Codes and Standards
   2. Conflicting Requirements
   3. Specifications and Drawing Conventions
   4. Work Restrictions
   5. Fees, Permits, and Inspection
   6. Submittals
   7. Products
   8. Warranties
   9. Delegated Design
   10. Coordination Drawings
   11. Operation and Maintenance Manuals
   12. Record Drawings
   13. Owner Training

1.03 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. 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.
   1. "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.

I. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process 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.

J. Basis-of-Design Product: A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, 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.

K. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

L. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

N. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

O. 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.

1.04 SYSTEM: AN ORGANIZED COLLECTION OF PARTS, EQUIPMENT, OR SUBSYSTEMS UNITED BY REGULAR INTERACTION.

A. Subsystem: A portion of a system with characteristics similar to a system.

B. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

C. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.05 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 in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ABMA	American Bearing Manufacturers Association	(202) 367-1155
	www.abma-dc.org	
AGA	American Gas Association	(202) 824-7000

	www.aga.org	
AIA	American Institute of Architects (The)	(800) 242-3837
	www.aia.org	(202) 626-7300
ANSI	American National Standards Institute	(202) 293-8020
	www.ansi.org	
ASCE	American Society of Civil Engineers	(800) 548-2723
	www.asce.org	(703) 295-6300
ASME	ASME International	(800) 843-2763
	(American Society of Mechanical Engineers International)	(973) 882-1170
	www.asme.org	
ASTM	ASTM International	(610) 832-9500
	(American Society for Testing and Materials International)	
	www.astm.org	
AWS	American Welding Society	(800) 443-9353
	www.aws.org	(305) 443-9353
CGA	Compressed Gas Association	(703) 788-2700
	www.cganet.com	
CSI	Construction Specifications Institute (The)	(800) 689-2900
	www.csinet.org	(703) 684-0300
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040
	www.ejma.org	
ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	

MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
STI	Steel Tank Institute	(847) 438-8265
	www.steeltank.com	
UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800

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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
	www.iccsafe.org	

C. 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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253

	Available from Access Board	(202) 272-0080
	www.access-board.gov	

1.06 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations, and the applicable requirements of the following adopted codes and standards.
   1. Building Codes for Arkansas
      a. International Building Code 2012
      b. Arkansas Fire Prevention Code 2021
      c. National Electrical Code 2020
      d. Arkansas Fuel Gas Code 2018
      e. Arkansas Energy Code 2014 (based on ANSI/ASHRAE/IESNA Standard 90.1-2007)
      f. Arkansas State Plumbing Code 2018
      g. International Mechanical Code 2021
      h. Accessibility Code ICC/ANSI A117.1 2003

1.07 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for 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 Engineer for a decision before proceeding.

1.08 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. 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 and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.09 FEES, PERMITS, AND INSPECTIONS

A. All required fees, permits and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.

B. Certificate of Final Inspection: Under each applicable section of the specifications, the Contractor shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.10 SUBMITTAL SCHEDULE

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 Engineer and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   3. Format: Arrange the following information in a tabular format:
      a. Specification Section number and title.
      b. Submittal category: Action; informational.
      c. Name of subcontractor.
      d. Description of the Work covered.
      e. Scheduled date for Engineer's final release or approval.

1.11 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit submittals to Architect.
   2. Engineer will return annotated file.

B. Digital Data Files:
   1. Electronic digital data files of the Project drawings may be provided by Architect for Contractor's use in preparing submittals.
   2. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. 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. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer 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 14 days for review of each resubmittal.

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 Engineer.
   4. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Engineer.
      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 Engineer.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

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 Engineer'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 Engineer's action stamp.

K. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
      a. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.12 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:
   1. Operation and Maintenance Materials
   2. Record Drawings
   3. Demonstration and Training Materials
   4. Final Approved Submittals

1.13 MAINTENANCE MATERIAL 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. Engineer 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 Engineer.
      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. In addition to the electronic submit provide two paper copies of the corrected final submittal as part of the “Closeout Documents”. Include a complete operation and

maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer will return two copies. The two paper copies will be provided to the Owner as part of the “Closeout Documents”

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
   1. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

1.14 QUALITY ASSURANCE

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

1.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
   1. 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 determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

B. 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 or moisture damage.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.

1.16 PRODUCT WARRANTIES

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

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submit warranties in accordance with “Closeout Procedures.”

1.17 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.18 WARRANTY

A. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the plumbing, air conditioning, ventilating, heating and control systems under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Submit electronic submittals to Architect.
    a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

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.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.
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.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100.

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000.

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700.

H. Maintenance Data: Comply with requirements specified in Section 01 7823.

I. 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 Engineers and owners, and other information specified.

J. 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.

K. 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.

L. 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.

M. Product Certificates: Submit written statements on manufacturer's letterhead certi fying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. 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.

P. 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.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.

3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. 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.

S. 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.

T. 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.

2.02 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Were two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," Engineer will make selection.
6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Products containing asbestos shall not be used.
8. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
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:
    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:

a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

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

2.03 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
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. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections,

2.04 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the

information and resolution of conflicts between installed components before submitting for review.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Mechanical and Plumbing Work: Show the following:
a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.
6. Electrical Work: Show the following:
a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Fire-Protection System: Show the following:
a. Locations of standpipes, main piping, branch lines, pipe drops, and sprinkler heads.
8. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Engineer will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: DXF operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and supply Portable Data File (PDF) format.

3. BIM File Incorporation: Provide coordination drawing files into Building Information Model established for Project.
    a. Provide three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Engineer.

2.05 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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. Include a section in the directory for each of the following:
    1. List of documents.
    2. List of systems.
    3. List of equipment.
    4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. 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.

B. Title Page: Include the following information:
    1. Subject matter included in manual.
    2. Name and address of Project.
    3. Name and address of Owner.
    4. Date of submittal.
    5. Name and contact information for Contractor.
    6. Names and contact information for major consultants to the Engineer that designed the systems contained in the manuals.
    7. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
    1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. 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.

2.07 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 has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

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.

2.08 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 and drawing or schedule designation or identifier where applicable.

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.
   1. Include procedures to follow and required notifications for warranty claims.

2.09 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 and drawing or schedule designation or identifier where applicable.

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.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

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. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

2.10 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Change Directive.
      k. Details not on the original Contract Drawings.
      l. Field records for variable and concealed conditions.
      m. Record information on the Work that is shown only schematically.
   3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   5. Mark important additional information that was either shown schematically or omitted from original Drawings.
   6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Annotated PDF electronic file.
   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 Engineer for resolution.
   4. Engineer will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
      a. See Section 01 3300 for requirements related to use of Engineer’s digital data files.
      b. Engineer will provide data file layer information. Record markups in separate layers.

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.
   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 Engineer.
      e. Name of Contractor.

PART 3 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL 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 Engineer.

B. 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.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

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 be returned by the Engineer without action.

3.03 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.
   3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 OPERATION AND MAINTENANCE 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.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

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.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

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.
   2. Comply with requirements of newly prepared record Drawings in "Project Record Documents."

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

3.05 RECORD DRAWING 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.

3.06 COORDINATION OF WORK

A. The Contractor shall compare the fire suppression Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the fire suppression work. The fire suppressions work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid

interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the fire suppression work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of pipes and equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. For example: plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
   2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all drains, etc., as required to effect these offsets, transitions and changes in direction.
   3. Installation and Arrangement: The Contractor shall install all fire suppression work to permit removal (without damage to other parts) of belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
   4. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, ducts, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves and dampers. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, supports, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All piping connecting to equipment shall be installed without strain at the piping connection

G. Inaccessible Equipment
   1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and

reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination
   1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
   2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
   3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26. The Contractor shall coordinate between this Division 21 and Division 26 to ensure that all disconnects required for the Project are furnished and installed.
   4. The Contractor of this Division shall furnish and install any low voltage relays, pressure switches, thermostats and similar items required for the proper operation of the HVAC equipment.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints. Provide 18 gauge (minimum) galvanized, 4 inch (minimum) deep drain pans under piping and ductwork located or passing over electrical equipment. Pipe 1” drain from pan to nearest floor drain. Drain pan shall be adequately supported and constructed to hold 4 inches of water without collapse.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Pump shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.07 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   2. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
   3. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
   4. Do not paint piping specialties with factory-applied finish.

5. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
6. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

END OF SECTION 21 0000

SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.

B. Escutcheons.

C. Mechanical couplings.

D. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

A. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2026.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24 Metric/Inch Standard; 2025.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2024.

G. ASME B16.11 - Forged Fittings, Socket-welding and Threaded; 2016 (Errata 2017).

H. ASME B16.25 - Buttwelding Ends; 2022.

I. ASME B36.10M - Welded and Seamless Wrought Steel Pipe; 2022.

J. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.

K. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

L. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

M. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

O. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

P. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

R. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

S. AWWA C606 - Grooved and Shouldered Joints; 2022.

T. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. UL (DIR) - Online Certifications Directory; Current Edition.

V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Project Record Documents: Record actual locations of components and tag numbering.

G. Operation and Maintenance Data: Include installation instructions and spare parts lists.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified in this section.
   1. Minimum three years experience.
   2. Approved by manufacturer.

C. Comply with FM (AG) and UL (DIR) requirements.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

E. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 BURIED PIPING

A. Steel Pipe: ASTM A53/A53M Schedule 40, ASTM A135/A135M Schedule 10, ASTM A795/A795M Standard Weight, or ASME B36.10M Schedule 40, black, with AWWA C105/A21.5 polyethylene jacket, or double layer, half-lapped polyethylene tape.
   1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASME B16.25, buttweld ends, ASTM A234/A234M, wrought carbon steel or alloy steel, ASME B16.5, steel flanges and

fittings, or ASME B16.11, forged steel socket welded and threaded; with double layer, half-lapped polyethylene tape.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings.
3. Joints: Welded in accordance with AWS D1.1/D1.1M.
4. Casing: Closed glass cell insulation.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, ASTM A135/A135M Schedule 10, or ASTM A795 Schedule 40, black.
1. Steel Fittings: ASME B16.5 steel flanges and fittings.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.04 ESCUTCHEONS

A. Material:
1. Fabricate from nonferrous metal.
2. Metals and Finish: Comply with ASME A112.18.1. Provide with custom paint color option.

B. Construction:
1. One-piece for mounting tubing or pipe and one-piece or split-pattern type elsewhere. Provide with custom painted color.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.05 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
1. Rings used as support shall be Heavy Duty and capable of supporting the total load of the pipe being supported. Tolco 200H or approved equal.

C. Wall support: Welded knee-brace and U-Bolt or strut and clamp.

D. Vertical Support: Steel riser clamp.

E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

F. Seismic Hangers and Couplings (Where required):
1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
2. Provide resettable and reusable, break away couplings.
3. Provide tether cables to avoid excessive seismic joint movement.
4. Coupling to be manufactured from non-corrosive materials.

2.06 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.

6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   2. Place hangers within 12 inches of each horizontal elbow.
   3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

I. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

J. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

K. Escutcheons:
   1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
   2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
   3. Attach plates at the underside only of suspended ceilings.
   4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

L. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

M. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 21 0500

SECTION 21 0523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

1.02 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies; 2025.

E. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Installer and Maintenance Contractor Qualifications:
   1. Company specializing in performing the work of this section with minimum five years documented experience.
   2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
   3. Complies with manufacturer's certification requirements.
   4. Complies with manufacturer's insurance requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.

2. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:

B. FM Global Approved: Provide valves listed in FM (AG) Approval Guide under the following headings:
   1. Automated Sprinkler Systems:
      a. Indicator posts.

C. Comply with NFPA 13 for valves.

D. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

3.02 INSTALLATION

A. Comply with specific valve installation requirements and application in the following Sections:

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
   1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in water supply connections and backflow preventer at potable water supply connections.

D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

E. Valves in horizontal piping installed with stem at or above the pipe center.

F. Position valves to allow full stem movement.

G. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 21 0523

SECTION 21 0548
VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration isolators.

D. External seismic snubber assemblies.

E. Seismic restraint systems

1.02 DEFINITIONS

A. Fire Suppression Component: Where referenced in this section in regards to seismic controls, applies to any portion of the fire suppression system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2014.

C. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

D. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

E. FM 1950 - Examination Standard for Seismic Sway Braces for Pipe, Tubing and Conduit; 2023.

F. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

G. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 203A - Standard for Sway Brace Devices for Sprinkler System Piping; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05 SUBMITTALS

A. See Division 01 for additional requirements.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed fire suppression component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
   2. Identify mounting conditions required for equipment seismic qualification.
   3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
   4. Indicate proposed arrangement of distributed system trapeze support groupings.
   5. Indicate proposed locations for distributed system flexible fittings and/or connections.
   6. Indicate locations of seismic separations where applicable.
   7. Include point load drawings indicating design loads transmitted to structure at each attachment location.

E. Seismic Design Data:
   1. Compile information on project-specific characteristics of actual installed fire suppression components necessary for determining seismic design forces required to design appropriate seismic controls.
   2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

F. Certification for seismically qualified equipment; identify basis for certification.

G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Evidence of qualifications for seismic controls designer.

J. Evidence of qualifications for manufacturer.

K. Manufacturer’s detailed field testing and inspection procedures.

L. Field quality control test reports.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing fire suppression equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.

D. Piping Isolation:
   1. Use flexible piping connections to vibration-isolated equipment.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide fire suppression component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor fire suppression components.

B. Seismic Design Criteria: Obtain from project Structural Engineer of Record or as indicated on the drawings.

C. Component Importance Factor (Ip): Fire suppression components to be assigned a component importance factor (Ip) of 1.5 unless otherwise indicated.

D. Seismic Qualification of Equipment:
   1. Provide special certification for fire suppression equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
   2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
   3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
   4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Premanufactured Modular Fire Suppression Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

F. Seismic Restraints:
   1. Provide seismic restraints for fire suppression components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
   2. Seismic Restraint Exemptions, All Seismic Design Categories:
      a. Fire Suppression Piping Exemptions, All Seismic Design Categories:
         1) Lateral sway bracing for piping individually supported within 6 inches of the structure measured between the top of pipe and the point of attachment to the structure, where all conditions for exception specified in NFPA 13 are met.
         2) Lateral sway bracing for branch lines smaller than 2-1/2 inches in diameter, where branch line restraint is provided in accordance with NFPA 13.
   3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
      a. ASHRAE (HVACA).
      b. FEMA 412.
      c. FEMA 413.
      d. FEMA 414.
      e. FEMA E-74.
   4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
   5. Seismic Type Vibration Isolators:
      a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   6. External Seismic Snubber Assemblies:
      a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
      b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
   7. Seismic Restraint Systems:
      a. Arrange restraint elements to avoid obstruction of sprinklers in accordance with NFPA 13.
      b. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
      c. Use only cable restraints to restrain vibration-isolated fire suppression components.
      d. Use only one restraint system type for a given fire suppression component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
      e. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain fire suppression component in all lateral directions; consider bracket geometry in anchor load calculations.
      f. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported fire suppression component weight.
      g. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported fire suppression component weight.
      h. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.

i. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
j. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.

G. Seismic Attachments:
1. Comply with support and attachment requirements of NFPA 13.
2. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
3. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
4. Do not use power-actuated fasteners.
5. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps, but not for sway bracing attachments as prohibited by NFPA 13.
6. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
7. Concrete Housekeeping Pads:
a. Increase size of pad as required to comply with anchor requirements.
b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

H. Seismic Interactions:
1. Include provisions to prevent seismic impact between fire suppression components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.
3. Comply with minimum clearance requirements between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs.

I. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections, in accordance with NFPA 13, to accommodate:
a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
c. Design displacements at seismic separations.
d. Anticipated drifts between floors.
2. Provide clearance around fire suppression system piping extending through walls, floors, platforms, and foundations in accordance with NFPA 13.

2.03 VIBRATION ISOLATORS

A. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
a. Color code or otherwise identify springs to indicate load capacity.
b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.

d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

3. Seismic Snubbing Elements for Seismic Isolators:
   a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

B. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.04 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:
   1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.05 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Where required by NFPA 13, provide products listed as complying with UL 203A or FM 1950.

C. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
   1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
   1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with certificate of compliance.
   2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
   3. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
   4. Verification of required clearances between other equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
   1. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   2. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   3. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   4. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   5. Adjust isolators to be free of isolation short circuits during normal operation.
   6. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

F. Seismic Controls:
   1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
   2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
   3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
   4. Equipment with Sheet Metal Housings:
      a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
      b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
      c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
   5. Concrete Housekeeping Pads:
      a. Size in accordance with seismic design to meet anchor requirements.
      b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

6. Seismic Restraint Systems:
    a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
    b. Install restraints within permissible angles in accordance with seismic design.
    c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
    d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
    e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. Inspect vibration isolation and/or seismic control components for damage and defects.

B. Vibration Isolation Systems:
    1. Verify isolator static deflections.
    2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

C. Seismic Controls:
    1. Verify snubbing element air gaps.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 21 0548

SECTION 21 0553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Pipe markers.

C. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.

B. Instrumentation: Nameplates.

C. Major Control Components: Nameplates.

D. Piping: Tags.

E. Pumps: Nameplates.

F. Small-sized Equipment: Nameplates.

G. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Thickness: 1/8 inch.
   5. Plastic: Comply with ASTM D709.

B. Metal rectangular nameplates to be used on valves. Indicate "NORMALLY OPEN" or "NORMALLY CLOSED" in all valves.

2.03 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

E. Lettering to be "FIRE PROTECTION WATER" or submit other text as appropriate.

F. Color code as follows:
   1. Fire Quenching Fluids: Red with white letters.

2.04 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install plastic pipe markers in accordance with manufacturer's instructions.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 21 0553

SECTION 21 1100
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water pipe.

B. Valves.

C. Fire department connections.

D. Bedding and cover materials.

E. Polyethylene jacketing (encasement).

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete; 2019 (Reapproved 2022).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

F. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

G. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

H. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe; 2022.

I. ASTM B63 - Standard Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials; 2007 (Reapproved 2026).

J. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications; 2022.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2026a.

L. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025, with Amendment (2026).

M. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings; 2022.

N. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

R. AWWA C502 - Dry-Barrel Fire Hydrants; 2024.

S. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2024.

T. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

U. AWWA M11 - Steel Pipe - A Guide for Design and Installation; 2017, with Addendum (2019).

V. FM (AG) - FM Approval Guide; Current Edition.

W. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Division 01 for additional requirements.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturer's catalog information.
   3. Indicate valve data and ratings.
   4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Project Record Documents:
   1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

F. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Division 01 for additional requirements.

1.06 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. Provide grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

F. Date stamp castings used for coupling housings, fittings, and valve bodies for quality assurance and traceability.

G. Welder Qualifications:
   1. Certify in accordance with ASME BPVC-IX.
   2. Provide certificate of compliance from local Authority Having Jurisdiction, indicating approval of welders.

H. Valves: Bearing product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.09 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 WATER PIPE

A. Ductile Iron Pipe: Listed, AWWA C104/A21.4:
   1. Fittings: Ductile iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket with rods.
   3. Jackets: AWWA C105/A21.5 polyethylene jacket.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Detector Check with Water Meter:

C. Detector Check Valve, Flanged End:
   1. 4 inch NPS up to and including 10 inch NPS:
      a. Construction:
         1) Body: Constructed of 300 series stainless steel or ASTM A536 ductile iron to AWWA C550, as applicable.
         2) Coating: Fusion bonded epoxy in accordance with AWWA C550.
         3) Spring and Linkage: Stainless steel.
         4) Removable Clapper Seat Ring: Bronze.
         5) Seat: ASTM B63 bronze.
         6) Maximum Working Pressure: 175 psi.

D. Double Check Detector Valve Assembly, Flanged End:
   1. 2-1/2 NPS up to and including 10 NPS:
      a. Construction:
         1) Two independently operating, spring-loaded, check valves.
         2) Two OSY resilient seated gate valves.
         3) Bypass Assembly:
            (a) Bypass Line: Hydraulically sized to accurately measure low flow.
            (b) Double check including shut-off valves, and required cocks.
         4) Cam-Check:
            (a) Internally loaded, providing positive, drip-tight closure against reverse flow.
            (b) Stainless steel cam arm and spring, rubber-faced disc, and replaceable, thermoplastic seat.
         5) Valve Cover:
            (a) Provides access to all internal parts.
            (b) Held in place through the use of a single grooved style two-bolt coupling.

2.03 FIRE DEPARTMENT CONNECTIONS:

A. Free-Standing Inlet:
   1. Construction:
      a. Type: Remote Free standing type, ASTM B584 poured brass alloy.
      b. Inlets: Two way, 2-1/2 inch female inlets, thread size compatible with fire department hardware.
      c. Rated Working Pressure: 175 psi.
      d. Double clapper-valves, rocker-lug caps and chain, and cast-in function-identifying lettering.
      e. Finish: Polished brass.
      f. Label: Sprinkler - Fire Department Connection.

2.04 POLYETHYLENE JACKETING (ENCASEMENT)

A. Comply with AWWA C105/A21.5 or ASTM A674.

B. Jackets: Double layer, half lapped, 10 mil polyethylene tape.

C. Type: Provide tubular based on the application.

D. Color: Manufacturer's standard color.

2.05 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03 3000.

B. Tracer Wire:
   1. Provide magnetic, detectable conductor with clear plastic covering and imprinted with "Water Service" in large letters.
   2. Conductor to be of sufficient length to be continuous over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide ____ sq feet thrust restraint bearing on subsoil.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION

A. General Requirements:
   1. Location of Water Lines:
   2. Sleeving:
      a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
      b. Provide ductile iron or Schedule 40 steel sleeves.
      c. Fill annular space between pipe and sleeves with mastic.

d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.

3. Pipe Laying and Jointing:
   a. Remove fins and burrs from pipe and fittings.
   b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
   c. Provide proper facilities for lowering pipe sections into trenches.
   d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
   e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
   f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
   g. Wedging or blocking between bells and spigots will not be permitted.
   h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
   i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
   j. Support piping at proper elevation and grade.
   k. Secure firm, uniform support.
   l. Wood support blocking will not be permitted.
   m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.
   n. Provide proper provisions for expansion and contraction of pipelines.
   o. Keep trenches free of water until joints have been properly made.
   p. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
   q. Do not install pipe during unacceptable trench conditions or inclement weather.
   r. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.
4. Tracer Wire:
   a. Install continuous length of tracer wire for the full length of each run of nonmetallic pipe.
   b. Attach wire to top of pipe securely to prevent displacement during installation.
5. Connections to Existing Water Lines:
   a. Ensure minimal interruption of service on the existing line.
   b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
6. Penetrations:
   a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
   b. Fill annular space between sleeves and walls with rich cement mortar.
   c. Fill annular space between pipe and sleeves with mastic.

B. Special Requirements:
1. Ductile Iron Piping:
   a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
   b. Jointing:
   c. Allowable Deflection:
      1) Maximum Allowable Deflection: As stated in AWWA C600.
      2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.
   d. Pipe Anchorage:
      1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.

2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.
3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.

e. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

C. Valves:
1. Set valves on solid bearing.
2. Center and plumb valve box over valve.
3. Set box cover flush with finished grade.

D. Fire Hydrants:
1. Install in accordance with NFPA 13, the Local Authority Having Jurisdiction, and the local water utility.
2. Set fire hydrant plumb and brace at grades and locations in upright position and as indicated.
3. Provide thrust blocks on all hydrant tees.
   a. Provide thrust block behind hydrant shoe if hydrant lateral is not restrained.
   b. Avoid covering drain ports, bolts, or fittings when placing concrete thrust block.
4. Install each fire hydrant with separate gate valve in supply pipe.
5. Installation of hydrants requiring changes in bury depth due to unforeseen obstructions requires the approval of the Architect in writing prior to installation.
6. Coating Requirements:
   a. Provide a color chip code sample in accordance with applicable NFPA standards for the hydrant bonnet indicating available flow at 20 psi according to the following:
      1) Supply Water Line Flow Characteristics/Bonnet Color:
7. Remove and dispose of unsuitable materials and debris in accordance with local or state requirements.

END OF SECTION 21 1100

SECTION 21 1300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Dry-pipe sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; Current Edition.

B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 1963 - Standard for Fire Hose Connections; 2019.

H. UL (DIR) - Online Certifications Directory; Current Edition.

I. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

B. Shop Drawings:
   1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
   2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
   3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

C. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

D. Designer's Qualification Statement.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
   2. Sprinkler Wrenches: For each sprinkler type.

I. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.06 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Comply with FM (AG) requirements.

C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

E. Installer Qualifications: Company specializing in performing the work of this section with at least 5 years documented experience..

F. Equipment and Components: Provide products that bear FM (AG) label or marking.

G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for building areas noted.

B. Occupancy: Ordinary hazard, Group 1; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Provide fire department connections where indicated.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

F. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
   6. Other Types: As required.

2.02 SPRINKLERS

A. Suspended Ceiling Type: Recessed pendant type with matching push on escutcheon plate and custom painted.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type.
   1. Response Type: Quick.
   2. Coverage Type: Standard.

3. Finish: Brass.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Recessed horizontal sidewall type with custon color push on escutcheon plate.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Dry Sprinklers: Concealed pendant type with matching push on escutcheon plate with custom color.
1. Response Type: Quick.
2. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E. Flexible Drop System: Stainless steel, multiple use, open gate type.
1. Application: Use to properly locate sprinkler heads.
2. Include all supports and bracing.
3. Provide braided type tube as required for the application.
4. Manufacturers:
a. Victaulic Company; Vic-Flex: www.victaulic.com

2.03 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:

B. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, accelerator, and with the following additional capabilities and features:

C. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.

D. Test Connections:
1. Inspector's Test Connection for Preaction Systems:
a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
c. Supply discharge orifice with same size as corresponding sprinkler orifice.
d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.

E. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

G. Fire Department Connections:
1. Type: Free standing made of corrosion resistant metal complying with UL 405.
a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
b. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.04 AIR COMPRESSOR

A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

B. Electrical Characteristics:
1. 120 volts, single phase, 60 Hz.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

G. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

H. Flush entire piping system of foreign matter.

I. Hydrostatically test entire system.

J. Require test be witnessed by Fire Marshal.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 1300

SECTION 22 0000
SUPPLEMENTARY PLUMBING GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes supplementary general requirements for the following :
   1. Codes and Standards
   2. Conflicting Requirements
   3. Specifications and Drawing Conventions
   4. Fees, Permits, and Inspection
   5. Submittals
   6. Closeout Submittals
   7. Quality Assurance
   8. Product Delivery, Storage, and Handling
   9. Product Warranties
   10. Product Selection Procedures
   11. Delegated Design
   12. Coordination Drawings
   13. Emergency, Operation, and Maintenance Manuals
   14. Construction Waste
   15. General Coordination for Plumbing Work
   16. Cutting and Patching
   17. Painting

1.03 DEFINITIONS

A. "Action Submittals": Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Basis-of-Design Product": A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, 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.

D. "Construction Waste": Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

E. "Cutting": Removal of in-place construction necessary to permit installation or performance of other work.

F. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

G. "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.

H. "File Transfer Protocol (FTP)": Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet

protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

I. "Furnish": To supply, deliver, unload, and inspect for damage.

J. "General": Basic Contract definitions are included in the Conditions of the Contract.

K. "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."

L. "Informational Submittals": Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. "Install": To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

N. "Patching": Fitting and repair work required to restore construction to original conditions after installation of other work.

O. "Portable Document Format (PDF)": An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

P. "Product": Material, machinery, components, equipment, fixtures,and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Product may be new, never before used, or re-used materials or equipment.

Q. "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.

R. "Provide": Furnish and install, complete and ready for the intended use.

S. "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.

T. "Salvage": Recovery of demolition and construction waste and subsequent sale or reuse in another facility.

U. "Salvage and Reuse": Recovery of demolition and construction waste and subsequent incorporation into the Work.

V. "System": An organized collection of parts, equipment, or subsystems united by regular interaction.

W. "Subsystem": A portion of a system with characteristics similar to a system.

1.04 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 in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AGA	American Gas Association	(202) 824-7000
	www.aga.org	
AIA	American Institute of Architects (The)	(800) 242-3837
	www.aia.org	(202) 626-7300
ANSI	American National Standards Institute	(202) 293-8020

	www.ansi.org	
ASCE	American Society of Civil Engineers	(800) 548-2723
	www.asce.org	(703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	(800) 527-4723
	www.ashrae.org	(404) 636-8400
ASME	ASME International	(800) 843-2763
	(American Society of Mechanical Engineers International)	(973) 882-1170
	www.asme.org	
ASTM	ASTM International	(610) 832-9500
	(American Society for Testing and Materials International)	
	www.astm.org	
AWS	American Welding Society	(800) 443-9353
	www.aws.org	(305) 443-9353
CGA	Compressed Gas Association	(703) 788-2700
	www.cganet.com	
CIMA	Cellulose Insulation Manufacturers Association	(888) 881-2462
	www.cellulose.org	(937) 222-2462
CSI	Construction Specifications Institute (The)	(800) 689-2900
	www.csinet.org	(703) 684-0300
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040
	www.ejma.org	
HI	Hydronics Institute	(908) 464-8200
	www.gamanet.org	
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association	(908) 464-8200
	Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)	
	www.ahrinet.org	
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510
	www.igmaonline.org	
ISA	Instrumentation, Systems, and Automation Society, The	(919) 549-8411
	www.isa.org	

ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	
NEBB	National Environmental Balancing Bureau	(301) 977-3698
	www.nebb.org	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
STI	Steel Tank Institute	(847) 438-8265
	www.steeltank.com	
TEMA	Tubular Exchanger Manufacturers Association	(914) 332-0040
	www.tema.org	
UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800
USGBC	U.S. Green Building Council	(800) 795-1747
	www.usgbc.org	

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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
	www.iccsafe.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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DOE	Department of Energy	(202) 586-9220
	www.energy.gov	
EPA	Environmental Protection Agency	(202) 272-0167

	www.epa.gov	
FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	
OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999
PHS	Office of Public Health and Science	(202) 690-7694
	http://www.hhs.gov/ophs/	
USP	U.S. Pharmacopeia	(800) 227-8772
	www.usp.org	
USPS	Postal Service	(202) 268-2000
	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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	

1.05 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations, and the applicable requirements of the following adopted codes and standards.
   1. Building Codes for Arkansas
      a. International Building Code 2021
      b. Arkansas Fire Prevention Code 2021
      c. National Electrical Code 2020
      d. Arkansas Fuel Gas Code 2018 (International Fuel Gas Code 2018)
      e. Arkansas Energy Code 2014 (based on ANSI/ASHRAE/IESNA Standard 90.1-2007)
      f. Arkansas State Plumbing Code 2018
      g. Arkansas Mechanical Code 2021
      h. Accessibility Code ICC/ANSI A117.1 2009

1.06 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for 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 Engineer for a decision before proceeding.

1.07 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. 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 and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
   4. The Plumbing Drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over Plumbing Drawings. Because of the small scale of the Plumbing Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, offsets, valves and accessories as may be required to meet such conditions.

1.08 FEES, PERMITS, AND INSPECTIONS

A. All required fees, permits and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.

B. Certificate of Final Inspection: Under each applicable section of the specifications, the Contractor shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.09 SUBMITTALS

A. Submittal Schedule
   1. 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 Engineer and additional time for handling and reviewing submittals required by those corrections.

a. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
b. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
c. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    1) Submit revised submittal schedule to reflect changes in current status and timing for submittals.
d. Format: Arrange the following information in a tabular format:
    1) Scheduled date for first submittal.
    2) Specification Section number and title.
    3) Submittal category: Action; informational.
    4) Name of subcontractor.
    5) Description of the Work covered.
    6) Scheduled date for Engineer's final release or approval.

B. Submittal Administrative Requirements
1. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
    a. Submit submittals to Engineer through the Architect.
    b. Engineer, through Architect, will return annotated file.
2. Digital Data Files:
    a. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
    b. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
    c. Electronic digital data file formats may include Revit converted to AutoCAD drawings.
3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
    a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    b. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
    c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
    d. 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.
        1) Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
4. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer'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.
    a. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
c. Resubmittal Review: Allow 14 days for review of each resubmittal.

5. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   a. 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.
   b. Name file with submittal number or other unique identifier, including revision identifier.
      1) 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).
   c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
   d. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
      1) Project name.
      2) Name and address of Architect.
      3) Name and address of Engineer.
      4) Name of Contractor.
      5) Name of firm or entity that prepared submittal.
      6) Names of subcontractor, manufacturer, and supplier.
      7) Category and type of submittal.
      8) Submittal purpose and description.
      9) Specification Section number and title.
      10) Specification paragraph number or drawing designation and generic name for each of multiple items.
      11) Drawing number and detail references, as appropriate.
      12) Location(s) where product is to be installed, as appropriate.
      13) Related physical samples submitted directly.
      14) Indication of full or partial submittal.
      15) Transmittal number.
      16) Submittal and transmittal distribution record.
      17) Other necessary identification.
      18) Remarks.
   e. Metadata: Include the following information as keywords in the electronic submittal file metadata:
      1) Project name.
      2) Number and title of appropriate Specification Section.
      3) Manufacturer name.
      4) Product name.
6. Options: Identify options requiring selection by Engineer.
7. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
8. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   a. Note date and content of previous submittal.
   b. Note date and content of revision in label or title block and clearly indicate extent of revision.

c. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

9. 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.
10. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.
11. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
    a. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
    b. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor through Architect of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
        1) Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.10 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:
    1. Operation and Maintenance Materials
    2. Final Approved Submittals

B. Operation and Maintenance Materials Submittals
    1. 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.
        a. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
        b. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
    2. Format: Submit operations and maintenance manuals in the following format:
        a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
            1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
            2) Enable inserted reviewer comments on draft submittals.
        b. In addition to the electronic submit provide two paper copies of the corrected final submittal as part of the "Closeout Documents". Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer, through Architect, will return two copies. The two paper copies will be provided to the Owner as part of the "Closeout Documents"
    3. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
        a. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

C. 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.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.
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.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."

H. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."

I. 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 Engineers and owners, and other information specified.

J. 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.

K. 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.

L. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

M. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

N. 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.

O. 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.

P. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

Q. Pre-construction 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.

R. 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.

S. 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.

1.11 QUALITY ASSURANCE

A. Products:
   1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
      a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
      b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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 determine compliance with the Contract Documents and to determine 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 or moisture damage..
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.

1.13 PRODUCT WARRANTIES

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

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

C. Submit warranties in accordance with “Closeout Procedures.”

1.14 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.15 WARRANTY

A. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the plumbing under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

PART 2 PRODUCTS

2.01 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 Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit 2 paper 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.

2.02 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Were two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   5. Where products are accompanied by the term "as selected," Architect will make selection.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   7. Products containing asbestos shall not be used.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   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:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
      b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   4. Manufacturers:
      a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
      b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics

that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Procedure: Where Specifications include the phrase "as selected by Architect" or similar phrase, select a product that complies with requirements. Architect will select option from manufacturer's product line that includes both standard and premium items.

D. Comparable Products
   1. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
      a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
      b. 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.
      c. Evidence that proposed product provides specified warranty.
      d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
      e. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections,

2.03 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed valves and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, low voltage, and electrical work. Supplement plan drawings with section drawings where required to adequately represent the work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, plumbing,fire protection, low voltage, and electrical equipment, and related work.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, low voltage, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Mechanical and Plumbing Work: Show the following:
    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.
6. Electrical Work: Show the following:
    a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Fire-Protection System: Show the following:
    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
    1. File Preparation Format: DXF operating in Microsoft Windows operating system.
    2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and supply Portable Data File (PDF) format.

2.04 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. Include a section in the directory for each of the following:
    1. List of documents.
    2. List of systems.
    3. List of equipment.
    4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to

ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. 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.

G. 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.

H. Operation Manual
   1. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
      a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
      b. Performance and design criteria if Contractor has delegated design responsibility.
      c. Operating standards.
      d. Operating procedures.
      e. Operating logs.
      f. Wiring diagrams.
      g. Control diagrams.
      h. Piped system diagrams.
      i. Precautions against improper use.
      j. License requirements including inspection and renewal dates.
   2. Descriptions: Include the following:
      a. Product name and model number. Use designations for products indicated on Contract Documents.
      b. Manufacturer's name.
      c. Equipment identification with serial number of each component.
      d. Equipment function.
      e. Operating characteristics.
      f. Limiting conditions.
      g. Performance curves.
      h. Engineering data and tests.
      i. Complete nomenclature and number of replacement parts.
   3. Operating Procedures: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Instructions on stopping.
      f. Normal shutdown instructions.
      g. Seasonal and weekend operating instructions.
      h. Required sequences for electric or electronic systems.
      i. Special operating instructions and procedures.

4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

I. Maintenance Manuals
   1. Content: Organize manual into a separate section for each product, system, subsystem, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
   2. Source Information: List each product, system, or subsystem included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
   3. Product Information: Include the following, as applicable:
      a. Product name and model number.
      b. Manufacturer's name.
      c. Color, pattern, and texture.
      d. Material and chemical composition.
      e. Reordering information for specially manufactured products.
      f. Standard maintenance instructions and bulletins.
      g. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
      h. Identification and nomenclature of parts and components.
      i. List of items recommended to be stocked as spare parts.
   4. Maintenance Procedures: Include manufacturer's written recommendations and the following:
      a. Inspection procedures.
      b. Types of cleaning agents to be used and methods of cleaning.
      c. List of cleaning agents and methods of cleaning detrimental to product.
      d. Schedule for routine cleaning and maintenance.
      e. Repair instructions.
      f. Test and inspection instructions.
      g. Troubleshooting guide.
      h. Precautions against improper maintenance.
      i. Disassembly; component removal, repair, and replacement; and reassembly instructions.
      j. Aligning, adjusting, and checking instructions.
      k. Demonstration and training video recording, if available.
   5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
   6. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
      a. Include procedures to follow and required notifications for warranty claims.
   7. 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.
      a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
      b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
   8. 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.
   9. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

10. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    a. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.01 CONTRACTOR'S SUBMITTAL 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. 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.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the Architect to forward to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

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 be returned by the Engineer without action.

3.03 CONSTRUCTION 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.
    3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 GENERAL COORDINATION FOR PLUMBING WORK

A. The Contractor shall compare the Plumbing Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the Plumbing Work. The Plumbing Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the Plumbing Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the

section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of pipes, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. For example: plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
   2. Offsets, transitions and changes in direction in pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, air vents, sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.
   3. Installation and Arrangement: The Contractor shall install all Plumbing Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
   4. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, supports, insulation, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All piping connecting to equipment shall be installed without strain at the piping connection

G. Inaccessible Equipment
   1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination

1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26. The Contractor shall coordinate between this Division and Division 26 to ensure that all disconnects required for the Project are furnished and installed.
4. The Contractor of this Division shall furnish and install any low voltage relays, pressure switches, and similar items required for the proper operation of the Plumbing equipment.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints.

3.05 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.
2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
3. 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. 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.

C. 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. Proceed with patching after construction operations requiring cutting are complete.

D. 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.
    a. Clean piping and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
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.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
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.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
1. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Do not paint piping specialties with factory-applied finish.
5. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
6. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

END OF SECTION 22 0000

SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2024.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2024.

1.03 SUBMITTALS

A. See Section Division 01, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section Division 01, for additional provisions.
   2. Extra Valve Stem Packings: Two for each type and size of valve.

1.04 QUALITY ASSURANCE

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

B. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch above finished floor.
   2. Provide sealant for watertight joint.
   3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
   4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
   1. Zinc coated or cast iron pipe.

2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

F. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
   3. Garlock; Link-Seal: www.garlock.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Modular/Mechanical Seal:
   1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
   2. Provide watertight seal between pipe and wall/casing opening.
   3. Elastomer element size and material in accordance with manufacturer's recommendations.
   4. Glass reinforced plastic pressure end plates.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:
   1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, partitions, and _____. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
    a. Pack solid using mineral fiber complying with ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 22 0517

SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.02 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section Division 01, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section Division 01. for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Moeller Instrument Company, Inc: www.moellerinstrument.com/#sle.
   3. Omega Engineering, Inc: www.omega.com/#sle.

B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
   1. Case: Steel with brass bourdon tube.
   2. Size: 4-1/2 inch diameter.
   3. Mid-Scale Accuracy: One percent.
   4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Manufacturers:
   1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
   2. Omega Engineering, Inc: www.omega.com/#sle.
   3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.

4. H.O. Trirece
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 7 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percent, per ASTM E77.
4. Calibration: Degrees F.

2.04 DIAL THERMOMETERS

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. H.O. Trerice.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5 inch diameter dial.
2. Lens: Clear glass.
3. Accuracy: 1 percent.
4. Calibration: Degrees F.

2.05 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.06 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.07 STATIC PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. H.O. Trereice.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

C. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

D. Coil and conceal excess capillary on remote element instruments.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

H. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 22 0519

SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.
B. General requirements.
C. Ball valves.
D. Check valves.
E. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.
B. Section 08 3100 - Access Doors and Panels.
C. Section 22 0553 - Identification for Plumbing Piping and Equipment.
D. Section 22 0719 - Plumbing Piping Insulation.
E. Section 22 1005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.
B. EPDM: Ethylene propylene copolymer rubber.
C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
D. NRS: Non-rising stem.
E. OS&Y: Outside screw and yoke.
F. PTFE: Polytetrafluoroethylene.
G. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).
B. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2022, with Errata (2023).
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.
D. ASME B16.34 - Valves — Flanged, Threaded, and Welding End; 2025.
E. ASME B31.9 - Building Services Piping; 2025.
F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2025.
G. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
H. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017 (Reapproved 2025).
I. MSS SP-67 - Butterfly Valves; 2022.
J. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.
K. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
L. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
M. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum
N. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
   2. Protect valve parts exposed to piped medium against rust and corrosion.
   3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
   4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
   5. Secure check valves in either the closed position or open position.
   6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors in dry environment.
      b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.08 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball, butterfly, gate or plug.
   2. Swing Check (Pump Outlet):
      a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Required Valve End Connections for Non-Wafer Types:
   1. Copper Tube:

a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

E. Domestic, Hot and Cold Water Valves:
1. 2 NPS and Smaller:
a. Bronze, Lead-Free _____: Provide with threaded ends.
b. Ball: Two piece, full port, _____ with stainless-steel trim.
c. Bronze Swing Check: Class 125, bronze disc.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:
1. Hand Lever: Quarter-turn valves 6 NPS and smaller except plug valves.
2. Wrench: Plug valves with square heads.

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:
1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:
1. Threaded End Valves: ASME B1.20.1.
2. Solder Joint Connections: ASME B16.18.

F. General ASME Compliance:
1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.
3. Building Services Piping Valves: ASME B31.9.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

H. Bronze Valves:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE BALL VALVES

A. Two Piece, Full Port with Stainless Steel Trim:
1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.
9. Manufacturers:
a. Apollo Valves; _____.
b. Nibco; T-585HP-66-lf.
c. Watts LFB6080G2-SS.
d. Webstone; H-x170.
e. Jomar Valve; T-200
f. Substitutions: See Section 01 6000 - Product Requirements.

2.04 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).
   1. Comply with MSS SP-80, Type 3.
   2. Design: Horizontal flow.
   3. Body: Bronze, lead-free, ASTM B62.
   4. Ends: Threaded as indicated.
   5. Disc: Bronze.
   6. Manufacturers:
      a. Apollo Valves61YLF: www.apollovalves.com/#sle.
      b. Jomar Valves; T-511G: www.jomarvalve.com.
      c. _____.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:
   1. Comply with MSS SP-78, Type II.
   2. Class 125: CWP Rating: 200 psig.
   3. Class 250: CWP Rating: 400 psig.
   4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
   5. Pattern: Regular or short.
   6. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:
   1. Lift Check: Install with stem plumb and vertical.
   2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 22 0523

SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping; 2025.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

H. MFMA-4 - Metal Framing Standards Publication; 2004.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

E. Installer's Qualifications: Include evidence of compliance with specified requirements.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with MSS SP-58.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      c. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

C. Metal Channel (Strut) Framing Systems:
   1. Manufacturers:

a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.
d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
   c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
2. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

F. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Manufacturers:
   a. Ferguson Enterprises Inc: www.fnw.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.
   c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:
1. Manufacturers:
   a. Ferguson Enterprises Inc: www.fnw.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.
   c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

I. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

J. Strut Clamps: Two-piece pipe clamp.
1. Manufacturers:
   a. Ferguson Enterprises Inc: www.fnw.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

K. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Manufacturers:
a. Ferguson Enterprises Inc; _____: www.fnw.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

L. Pipe Alignment Guides: Galvanized steel.
1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.
2. Pipe Diameter 10 inches and Larger: Roller type.

M. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

N. Pipe Shields for Insulated Piping:
1. Manufacturers:
a. Anvil International: www.anvilintl.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.
c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
b. Shields Material: UV-resistant polypropylene with glass fill.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

O. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
a. Hilti, Inc: www.us.hilti.com/#sle.
b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
c. Powers Fasteners, Inc: www.powers.com/#sle.
d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
e. Substitutions: See Section 01 6000 - Product Requirements.
2. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
5. Hollow Masonry: Use toggle bolts.
6. Hollow Stud Walls: Use toggle bolts.
7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
8. Sheet Metal: Use sheet metal screws.
9. Wood: Use wood screws.
10. Plastic and lead anchors are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
a. Comply with MFMA-4.

b. Channel Material: Use galvanized steel.
c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

P. Pipe Installation Accessories:
1. PEX Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
2) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
2. Plenum Pipe Supports:
a. Manufacturers:
1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
2) Substitutions: See Section 01 6000 - Product Requirements.
3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

G. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 22 0529

SECTION 22 0548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 DEFINITIONS

A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2014.

E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.

F. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

H. MFMA-4 - Metal Framing Standards Publication; 2004.

I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2024.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 SUBMITTALS

A. See Section Division 01 for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

D. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
   2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Seismic Design Data:
   1. Compile information on project-specific characteristics of actual installed plumbing components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
   2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

F. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

G. Evidence of qualifications for seismic controls designer.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.

b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.

2.02 VIBRATION ISOLATORS

A. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
a. Color code or otherwise identify springs to indicate load capacity.
b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

B. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.

2.03 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:
1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
2. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:
1. Vibration-Isolated Equipment Support Bases:
a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
a. Position equipment at operating height; provide temporary blocking as required.
b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 22 0548

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment: Nameplates.

B. Piping: Pipe markers.

C. Pumps: Nameplates.

D. Small-sized Equipment: Tags.

E. Valves: Tags _____.

2.02 NAMEPLATES

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Division 01 .

B. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Seton Identification Products: www.seton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:
   1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch diameter and smaller.
   1. Identify service, flow direction, and pressure.
   2. Install in clear view and align with axis of piping.
   3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

3.03 SCHEDULES: INSTALL BELOW PER ANSI A13.1 STANDARDS

A. Equipment Type:
   1. Identification: Name of Equipment
   2. Background:
      a. Size:
      b. Color: Black
   3. Lettering:
      a. Size:
      b. Color: White

B. Potable Water:
   1. Background:
      a. Size: Per pipe OD
      b. Color: Green

2. Lettering:
    a. Size: Per pipe OD
    b. Color: White

C. Natural Gas/LP Gas:
1. Background:
    a. Size: Per pipe OD
    b. Color: Yellow
2. Lettering:
    a. Size: Per pipe OD
    b. Color: Black

END OF SECTION 22 0553

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2025.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Johns Manville Corporation; Micro-Lok: www.jm.com/#sle.
   2. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
   3. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. K Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation; _____: www.jm.com/#sle.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:
   1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
   2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert Location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Plumbing Systems:
   1. Domestic Cold Water:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: All Sizes.
            (a) Thickness: 1/2 inch.
   2. Domestic Hot Water Supply and Hot Water Recirculation:
      a. Glass Fiber Insulation:
         1) Pipe Size Range: NPS 2" and Larger.
            (a) Thickness: 1 inch.
         2) Pipe Size Range: NPS 2-1/2" and Larger.
            (a) Thickness: 1-1/2" inch.

END OF SECTION 22 0719

SECTION 22 1005
PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Storm water.
   4. Flanges, unions, and couplings.

1.02 RELATED REQUIREMENTS

A. Section 22 0719 - Plumbing Piping Insulation.

B. Section 31 2316 - Excavation.

C. Section 31 2316.13 - Trenching.

D. Section 31 2323 - Fill.

E. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

D. ASME B31.1 - Power Piping; 2018.

E. ASME B31.9 - Building Services Piping; 2025.

F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

H. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2026.

I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

J. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

K. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2025.

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

M. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

N. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

O. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2026.

P. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).

Q. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.

R. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).

S. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2019a.

T. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing; 2019a.

U. AWWA C606 - Grooved and Shouldered Joints; 2022.

V. AWWA C651 - Disinfecting Water Mains; 2023.

W. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

X. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

Y. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

Z. NSF 372 - Drinking Water System Components - Lead Content; 2016.

AA. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2017.

1.04 SUBMITTALS

A. See Section Division 01, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water.

C. All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and listed by NSF International.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets. .
   3. Tensile Strength: 21,000 psig minimum.
   4. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute ® and listed by NSF International.
   5. Each length of pipe and each fitting shall be plainly marked with size, country of origin, and name of manufacturer, or manufacturer's registered trademark by which the manufacturer can be readily identified after installation.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: ASTM A 888 and CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.
   3. CISPI, Hubless-Piping Couplings:
      a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
         1) a. Ideal Tridon
         2) b. ANACO-Husky
         3) c. Tyler Couplings
         4) d. Mission Rubber Company
      b. Standards: ASTM C 1277 and CISPI 310.
      c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop. Couplings shall bear the trademark NSF International.
      d. Couplings in "Heavy-Duty, Hubless-Piping Couplings" Paragraph below are made in NPS 1-1/2 to NPS 15.
   4. Heavy-Duty, Hubless-Piping Couplings:
      a. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
         1) a. Ideal Tridon
         2) b. ANACO-Husky
         3) c. Tyler Couplings
         4) d. Mission Rubber Company
      b. Standards: ASTM C 1540.
      c. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

B. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, Type K, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: AWS A5.8M/A5.8, BCuP copper/silver braze.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
1. Manufacturers:
a. Uponor, Inc: www.uponorengineering.com/#sle.
b. Viega LLC; PureFlow PEX with Corrugated Sleeve: www.viega.us/#sle.
2. PPI TR-4 Pressure Design Basis:
3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
4. Joints: ASTM F1960 cold-expansion fittings.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.
a. Manufacturers:
1) Anvil International: www.anvilintl.com/#sle.
2) Apollo Valves: www.apollovalves.com/#sle.
3) Grinnell Products: www.grinnell.com/#sle.
4) Viega LLC: www.viega.us/#sle.
5) Substitutions: See Section 01 6000 - Product Requirements.

2.06 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
1. Fittings: Cast iron.
2. Joint Seals: ASTM C564 neoprene gaskets.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
1. Fittings: Cast iron.
2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
a. CISPI, Hubless-Piping Couplings:
b. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
1) Ideal Tridon
2) ANACO-Husky
3) Tyler Couplings
4) Mission Rubber Company
c. Standards: ASTM C 1277 and CISPI 310.
d. Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop. Couplings shall bear the trademark NSF International.
e. Couplings in "Heavy-Duty, Hubless-Piping Couplings" Paragraph below are made in NPS 1-1/2 to NPS 15 .
f. Heavy-Duty, Hubless-Piping Couplings:Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
1) Ideal Tridon
2) ANACO-Husky
3) Tyler Couplings.

4) Mission Rubber Company.

g. Standards: ASTM C 1540.Description: Shield Assemblies shall consist of stainless-steel bi-directional corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

B. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.08 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

2.09 FLANGES, UNIONS, AND COUPLINGS

A. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Buried CPVC and PVC pipe shall be installed in accordance with ASTM D 2321 and ASTM F 1668.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
   1. Refer to Section 22 0719.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

K. Install bell and spigot pipe with bell end upstream.

L. Install water piping to ASME B31.9.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

N. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

O. Sleeve pipes passing through partitions, walls, and floors.

P. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 0110.58.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approvedreduced pressure backflow preventer.

3.08 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inches to 1-1/4 inches:
         1) Maximum Hanger Spacing: 6.5 ft.

2) Hanger Rod Diameter: 3/8 inches.

b. Pipe Size: 1-1/2 inches to 2 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 3/8 inch.

c. Pipe Size: 2-1/2 inches to 3 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 1/2 inch.

d. Pipe Size: 4 inches to 6 inches:
   1) Maximum Hanger Spacing: 10 ft.
   2) Hanger Rod Diameter: 5/8 inch.

END OF SECTION 22 1005

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hydrants.
D. Refrigerator valve and recessed box.
E. Backflow preventers.
F. Water hammer arrestors.
G. Sanitary waste interceptors.
H. Mixing valves.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.
B. Section 22 3000 - Plumbing Equipment.
C. Section 22 4000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASME A112.6.3 - Floor Drains; 2022.
C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.
D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.
E. ASSE 1013 - Reduced Pressure Principle (RP) Backflow Prevention Assemblies; 2026.
F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.
G. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum
H. NSF 372 - Drinking Water System Components - Lead Content; 2016.
I. PDI-WH 201 - Water Hammer Arresters; 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
E. Manufacturer's Qualification Statement.
F. Operation Data: Indicate frequency of treatment required for interceptors.
G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

B. Refer to plumbing schedules on drawings for piping specialties requirements not defined in this section.

2.02 DRAINS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Drains: Refer to Schedule on Drawings.
   1. Assembly: ASME A112.6.4.
   2. Body: Lacquered cast iron with sump.
   3. Strainer: Removable polyethylene dome with vandal proof screws.
   4. Accessories: Coordinate with roofing type, refer to Section _____:
      a. Membrane flange and membrane clamp with integral gravel stop.
      b. Adjustable under deck clamp.
      c. Roof sump receiver.
      d. Adjustable extension sleeve for roof insulation.
   5. Manufacturers:
      a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
      b. MIFAB, Inc: www.mifab.com/#sle.
      c. Zurn Industries.
      d. Substitutions: See Section 01 6000 - Product Requirements.

C. Floor Drains: Refer to Schedule on Drawings.
   1. Manufacturers:
      a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
      b. MIFAB, Inc: www.mifab.com/#sle.
      c. Zurn Industries.
      d. Substitutions: See Section 01 6000 - Product Requirements.

D. Floor Sinks:Refer to Schedule on Drawings.
   1. Lacquered cast iron body with dome strainer and seepage flange.
   2. Manufacturers:
      a. MIFAB, Inc: www.mifab.com/#sle.
      b. JR Smith.
      c. Zurn Industries.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 CLEANOUTS REFER TO SCHEDULE ON DRAWINGS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. MIFAB, Inc: www.mifab.com/#sle.
   4. Zurn Industries, LLC: www.zurn.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas :
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas:

1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HYDRANTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   3. Woodford.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants: Refer to Schedule on Drawings.
   1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

2.05 REFRIGERATOR VALVE AND RECESSED BOX

A. Box Manufacturers:
   1. IPS Corporation/Water-Tite: www.ipscorp.com/#sle.
   2. Oatey Supply Chain Services, Inc: www.oatey.com/#sle.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Valve Manufacturers:
   1. IPS Corporation/Water-Tite; _____: www.ipscorp.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventers: Refer to Schedule on Drawings.
   1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

2.07 WATER HAMMER ARRESTORS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company; _____: www.jayrsmith.com/#sle.
   2. Watts Regulator Company, a part of Watts Water Technologies; _____: www.wattsregulator.com/#sle.
   3. Zurn Industries, LLC; _____: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.08 SANITARY WASTE INTERCEPTORS

A. Grease Interceptors: Refer to Schedule on Drawings
   1. Construction:
      a. Material: High-density polyethylene.
      b. Rough-in: Below Grade_____.
      c. Cover: Steel, epoxy coated, non-skid with gasket, securing handle, and enzyme injection port, recessed for floor finish.
   2. Manufacturers:
      a. Schier Products; GB-250.

2.09 MIXING VALVES

A. Thermostatic Mixing Valves:
   1. Manufacturers:
      a. Cash Acme, a brand of Reliance Worldwide Corporation; _____: www.cashacme.com/#sle.
      b. Leonard Valve Company; _____: www.leonardvalve.com/#sle.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
   3. Accessories:
      a. Check valve on inlets.
      b. Volume control shut-off valve on outlet.
      c. Stem thermometer on outlet.
      d. Strainer stop checks on inlets.

2.10 AIR VENTS

A. Manufacturers:
   1. Cash Acme, a brand of Reliance Worldwide Corporation; _____: www.cashacme.com/#sle.
   2. ITT Bell & Gossett; _____: www.bellgossett.com/#sle.
   3. Taco, Inc; _____: www.taco-hvac.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Float Type:
   1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
   2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

2.11 FLOOR DRAIN TRAP SEALS

A. Manufacturers:
   1. MIFAB, Inc; _____: www.mifab.com/#sle.
   2. Provent.
   3. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to fixture.

END OF SECTION 22 1006

SECTION 22 1429
SUMP PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submersible sump pumps.

B. Sump basins and pits.

1.02 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. See Division 01 for submittal procedures.

B. Product Data: Provide certified pump chart or curve with duty point marked over.

C. Shop Drawings: Include dimensions and performance data.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Executed warranty.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with three years minimum of documented experience.

B. Certifications: UL (DIR) listed, classified, and suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for pumps and related components. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
   1. Grundfos Pumps Corporation; SL Series: www.grundfos.com/#sle.
   2. Zoeller Company; _____: www.zoeller.com/#sle.
   3. _____.

B. General: Rugged stainless steel and cast iron housing and base with oil-filled motor chamber, ball bearings, and mechanical seal.

C. Impeller: Thermoplastic; open nonclog, stainless steel shaft.

D. Motor: Base mount, enclosed, lubricated oil-free, thermal-overload protected, continuous duty, permanent split capacitor with oil-resistant, three-prong connector, 10 foot power cord.

E. Controls: Integral, chemically-resistant, vertical plated-steel rod float switch. Cycle pump Off/On between 2.5 and 9 inch heights from bottom of pump.

F. Solids Handling Capacity: Pass lint and other small solids up to 1/2 inch in size.

G. Discharge Pipe Size: 2 inch, NPT, female.

H. Maximum Water-Based Effluent Temperature: 120 degrees F.

I. Accessories: Provide full flow swing-type discharge check valve.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings and accessories according to manufacturer instructions.

B. Observe and provide incidentals required to complete installation in compliance with ICC (IPC).

END OF SECTION 22 1429

SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial gas fired.
   2. Residential electric.

B. Diaphragm-type compression tanks.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z21.10.1 - Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less; 2019 (Reaffirmed 2024).

B. ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous; 2019 (Reaffirmed 2024).

C. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2025, with Errata .

D. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Division 01 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Gas Water Heaters: Certified by _____ to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.

2. Electric Water Heaters: UL listed and labeled to UL 174.
3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 - PRODUCTS

2.01 WATER HEATERS

A. Commercial Gas Fired:
1. Type: Automatic, propane-fired, vertical storage.
2. Performance:
   a. Refer to equipment schedules.
3. Tank: Glass lined welded steel ASME labeled; multiple flue passages, 4 inch diameter inspection port, thermally insulated with minimum 2 inches glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
4. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.
   d. Anode: Magnesium.
   e. Temperature and Pressure Relief Valve: ASME labeled.
5. Certified For The Following Applications:
   a. For operation at 180 degrees F.
6. Controls: Automatic water thermostat with temperature range adjustable from 120 to 180 degrees F, automatic reset high temperature limiting thermostat factory set at 195 degrees F, gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.

B. Residential Electric:
1. Type: Automatic, electric, vertical storage.
2. Performance:
   a. Refer to equipment schedules.
3. Electrical Characteristics:
4. Tank: Glass lined welded steel, thermally insulated with one inch thick glass fiber; encased in corrosion-resistant steel jacket; baked-on enamel finish.
5. Controls: Automatic water thermostat with externally adjustable temperature range from 120 to 170 degrees F, flanged or screw-in nichrome elements, enclosed controls and electrical junction box and operating light. Wire double element units so elements do not operate simultaneously.
6. Accessories:
   a. Water Connections: Brass.
   b. Dip Tube: Brass.
   c. Drain valve.
   d. Anode: Magnesium.

e. Temperature and Pressure Relief Valve: ASME labeled.

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers: Refer to Schedule on Drawings
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Bell & Gossett, a xylem brand: www.bellgossett.com/#sle.
   3. Taco, Inc: www.taco-hvac.com/#sle.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 55 ___ psig.

D.

2.03 IN-LINE CIRCULATOR PUMPS

A. Casing: Bronze, rated for 125 psig working pressure, with stainless steel rotor assembly.

B. Impeller: Noryl.

C. Shaft: Ceramic with integral thrust collar and two oil lubricated bronze sleeve bearings.

D. Seal: Carbon rotating against a stationary ceramic seat.

E. Drive: Flexible coupling.

2.04 ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.

D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Pumps:
   1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
   2. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 22 3000

SECTION 22 4000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Under-lavatory pipe supply covers.

1.02 SUBMITTALS

A. See Division 0101 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Refer to plumbing schedules on plumbing drawings for fixture requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 WALL HUNG URINALS

A. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
   1. Flush Volume: 0.125 gallons, maximum.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: Sensor operated.

4. Trap: Integral.
5. Supply Size: 3/4 inch.
6. Outlet Size: 2 inches.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
1. Sensor-Operated Type: Solenoind or motor-driven operator, low voltage hard-wired, infrared sensor with mechanical over-ride or over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
3. Manufacturers:
a. American Standard, Inc: www.americanstandard-us.com/#sle.
b. Sloan Valve Company: www.sloanvalve.com/#sle.
c. Zurn Industries, Inc: www.zurn.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Carriers:
1. Manufacturers:
a. Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
b. Zurn Industries, Inc: www.zurn.com/#sle.
c. Substitutions: See Section 01 6000 - Product Requirements.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.04 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
2. Trubro, IPS Corporation; Lav Guard 2.
3. McGuire; ProWrap.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com/#sle.
1. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.

C. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads and two ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
a. Provide one piece injected molded design with internal bridge at top of J-bend to prevent separating.
b. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
d. Comply with ICC A117.1.
e. Thermal Resistance: R value of 0.504 or lower when tested by ASTM C177.
f. Thermal Conductivity: K value of 0.358 or density of 21.61 pcf per ASTM C518.
g. Microbial and Fungal Resistance for Interior and Exterior: Comply with ASTM G21.
5. Color: High gloss white.
6. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

A. Fixture Heights: Install fixtures to heights above finished floor as indicated.
   1. Water Closet:
      a. Standard: 15 inches to top of bowl rim.
      b. Accessible: 18 inches to top of seat.
   2. Water Closet Flush Valves:
      a. Standard: 11 inches min. above bowl rim.
      b. Recessed: 10 inches min. above bowl rim.
   3. Urinal:
      a. Standard: 22 inches to top of bowl rim.
      b. Accessible: 17 inches to top of bowl rim.
   4. Lavatory:
      a. Standard: 31 inches to top of basin rim.
      b. Accessible: 34 inches to top of basin rim.

B. Fixture Rough-In
   1. Water Closet (Tank Type):
      a. Cold Water: 1/2 Inch.
      b. Waste: 4 Inch.
      c. Vent: 2 Inch.
   2. Lavatory:
      a. Hot Water: 3/8 Inch.
      b. Cold Water: 3/8 Inch.

c. Waste: 1-1/4 Inch.
d. Vent: 2 Inch.

3. Sink:
   a. Hot Water: 1/2 Inch.
   b. Cold Water: 1/2 Inch.
   c. Waste: 1-1/2 Inch.
   d. Vent: 2 Inch.

END OF SECTION 22 4000

SECTION 23 0000
SUPPLEMENTARY HVAC GENERAL CONDITIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes supplementary general requirements for the following :
   1. Codes and Standards
   2. Conflicting Requirements
   3. Specifications and Drawing Conventions
   4. Fees, Permits, and Inspection
   5. Submittals
   6. Closeout Submittals
   7. Quality Assurance
   8. Product Delivery, Storage, and Handling
   9. Product Warranties
   10. Product Selection Procedures
   11. Delegated Design
   12. Coordination Drawings
   13. Emergency, Operation, and Maintenance Manuals
   14. Construction Waste
   15. General Coordination for HVAC Work
   16. Cutting and Patching
   17. Painting

1.03 DEFINITIONS

A. "Action Submittals": Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Basis-of-Design Product": A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, 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.

D. "Construction Waste": Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

E. "Cutting": Removal of in-place construction necessary to permit installation or performance of other work.

F. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

G. "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.

H. "File Transfer Protocol (FTP)": Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet

protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

I. "Furnish": To supply, deliver, unload, and inspect for damage.

J. "General": Basic Contract definitions are included in the Conditions of the Contract.

K. "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."

L. "Informational Submittals": Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. "Install": To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

N. "Patching": Fitting and repair work required to restore construction to original conditions after installation of other work.

O. "Portable Document Format (PDF)": An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

P. "Product": Material, machinery, components, equipment, fixtures,and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Product may be new, never before used, or re-used materials or equipment.

Q. "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.

R. "Provide": Furnish and install, complete and ready for the intended use.

S. "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.

T. "Salvage": Recovery of demolition and construction waste and subsequent sale or reuse in another facility.

U. "Salvage and Reuse": Recovery of demolition and construction waste and subsequent incorporation into the Work.

V. "System": An organized collection of parts, equipment, or subsystems united by regular interaction.

W. "Subsystem": A portion of a system with characteristics similar to a system.

1.04 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 in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AABC	Associated Air Balance Council	(202) 737-0202
	www.aabchq.com	
AGA	American Gas Association	(202) 824-7000
	www.aga.org	
AHRI	Air Conditioning, Heating, and Refrigeration Institute	(703) 524-8800

	www.ahrinet.org	
AIA	American Institute of Architects (The)	(800) 242-3837
	www.aia.org	(202) 626-7300
AMCA	Air Movement and Control Association International, Inc.	(847) 394-0150
	www.amca.org	
ANSI	American National Standards Institute	(202) 293-8020
	www.ansi.org	
ARI	Air-Conditioning & Refrigeration Institute	(703) 524-8800
	www.ari.org	
ASCE	American Society of Civil Engineers	(800) 548-2723
	www.asce.org	(703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	(800) 527-4723
	www.ashrae.org	(404) 636-8400
ASME	ASME International	(800) 843-2763
	(American Society of Mechanical Engineers International)	(973) 882-1170
	www.asme.org	
ASTM	ASTM International	(610) 832-9500
	(American Society for Testing and Materials International)	
	www.astm.org	
AWS	American Welding Society	(800) 443-9353
	www.aws.org	(305) 443-9353
CGA	Compressed Gas Association	(703) 788-2700
	www.cganet.com	
CIMA	Cellulose Insulation Manufacturers Association	(888) 881-2462
	www.cellulose.org	(937) 222-2462
CSI	Construction Specifications Institute (The)	(800) 689-2900
	www.csinet.org	(703) 684-0300
CTI	Cooling Technology Institute	(281) 583-4087
	www.cti.org	
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040
	www.ejma.org	

HI	Hydronics Institute	(908) 464-8200
	www.gamanet.org	
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association	(908) 464-8200
	Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)	
	www.ahrinet.org	
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510
	www.igmaonline.org	
ISA	Instrumentation, Systems, and Automation Society, The	(919) 549-8411
	www.isa.org	
ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	
NADCA	National Air Duct Cleaners Association	(202) 737-2926
	www.nadca.com	
NEBB	National Environmental Balancing Bureau	(301) 977-3698
	www.nebb.org	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	(703) 803-2980
	www.smacna.org	
STI	Steel Tank Institute	(847) 438-8265
	www.steeltank.com	
TEMA	Tubular Exchanger Manufacturers Association	(914) 332-0040
	www.tema.org	

UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800
USGBC	U.S. Green Building Council	(800) 795-1747
	www.usgbc.org	

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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
	www.iccsafe.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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DOE	Department of Energy	(202) 586-9220
	www.energy.gov	
EPA	Environmental Protection Agency	(202) 272-0167
	www.epa.gov	
FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	
OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999
PHS	Office of Public Health and Science	(202) 690-7694
	http://www.hhs.gov/ophs/	
USP	U.S. Pharmacopeia	(800) 227-8772
	www.usp.org	
USPS	Postal Service	(202) 268-2000
	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. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	

1.05 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations, and the applicable requirements of the following adopted codes and standards.
   1. Building Codes for Arkansas
      a. Arkansas Fire Prevention Code 2021
      b. National Electrical Code 2020
      c. Arkansas Fuel Gas Code 2018
      d. Arkansas Energy Code 2011 (based on ANSI/ASHRAE/IESNA Standard 90.1-2007)
      e. Arkansas State Plumbing Code 2018
      f. International Mechanical Code 2021

1.06 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for 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 Engineer for a decision before proceeding.

1.07 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. 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 and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
4. The HVAC Drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over HVAC Drawings. Because of the small scale of the HVAC Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, offsets, valves and accessories as may be required to meet such conditions.

1.08 FEES, PERMITS, AND INSPECTIONS

A. All required fees, permits and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.

B. Certificate of Final Inspection: Under each applicable section of the specifications, the Contractor shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.09 SUBMITTALS

A. Submittal Schedule
   1. 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 Engineer and additional time for handling and reviewing submittals required by those corrections.
      a. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
      b. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
      c. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
         1) Submit revised submittal schedule to reflect changes in current status and timing for submittals.
      d. Format: Arrange the following information in a tabular format:
         1) Scheduled date for first submittal.
         2) Specification Section number and title.
         3) Submittal category: Action; informational.
         4) Name of subcontractor.
         5) Description of the Work covered.
         6) Scheduled date for Engineer's final release or approval.

B. Submittal Administrative Requirements
   1. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
      a. Submit submittals to Engineer through the Architect.
      b. Engineer, through Architect, will return annotated file.
   2. Digital Data Files:
      a. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.

b. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer's Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
c. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings, or Revit model.

3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   b. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   d. 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.
      1) Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
4. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer'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.
   a. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
   b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   c. Resubmittal Review: Allow 14 days for review of each resubmittal.
5. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   a. 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.
   b. Name file with submittal number or other unique identifier, including revision identifier.
      1) 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).
   c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
   d. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
      1) Project name.
      2) Name and address of Architect.
      3) Name and address of Engineer.
      4) Name of Contractor.
      5) Name of firm or entity that prepared submittal.
      6) Names of subcontractor, manufacturer, and supplier.
      7) Category and type of submittal.
      8) Submittal purpose and description.
      9) Specification Section number and title.

10) Specification paragraph number or drawing designation and generic name for each of multiple items.
11) Drawing number and detail references, as appropriate.
12) Location(s) where product is to be installed, as appropriate.
13) Related physical samples submitted directly.
14) Indication of full or partial submittal.
15) Transmittal number.
16) Submittal and transmittal distribution record.
17) Other necessary identification.
18) Remarks.

e. Metadata: Include the following information as keywords in the electronic submittal file metadata:
1) Project name.
2) Number and title of appropriate Specification Section.
3) Manufacturer name.
4) Product name.

6. Options: Identify options requiring selection by Engineer.
7. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
8. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
a. Note date and content of previous submittal.
b. Note date and content of revision in label or title block and clearly indicate extent of revision.
c. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
9. 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.
10. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.
11. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
a. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
b. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor through Architect of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
1) Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.10 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:
1. Operation and Maintenance Materials
2. Final Approved Submittals

B. Operation and Maintenance Materials Submittals
1. 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.

a. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
b. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

2. Format: Submit operations and maintenance manuals in the following format:
   a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
      1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      2) Enable inserted reviewer comments on draft submittals.
   b. In addition to the electronic submit provide two paper copies of the corrected final submittal as part of the “Closeout Documents”. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer, through Architect, will return two copies. The two paper copies will be provided to the Owner as part of the “Closeout Documents”
3. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
   a. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

C. 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.

D. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.
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.

E. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."

G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."

H. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."

I. 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 Engineers and owners, and other information specified.

J. 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.

K. 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.

L. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

M. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

N. 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.

O. 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.

P. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

Q. Pre-construction 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.

R. 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.

S. 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.

1.11 QUALITY ASSURANCE

A. Products:
   1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
      a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
      b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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 determine compliance with the Contract Documents and to determine 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 or moisture damage..
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.

1.13 PRODUCT WARRANTIES

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

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submit warranties in accordance with “Closeout Procedures.”

1.14 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.15 WARRANTY

A. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the HVAC under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

PART 2 PRODUCTS

2.01 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 Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit 2 paper 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.

2.02 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Were two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," Architect will make selection.
6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Products containing asbestos shall not be used.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
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:
    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Procedure: Where Specifications include the phrase "as selected by Architect" or similar phrase, select a product that complies with requirements. Architect will select option from manufacturer's product line that includes both standard and premium items.

D. Comparable Products
1. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
    a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
    b. 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.
    c. Evidence that proposed product provides specified warranty.
    d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
    e. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections,

2.03 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed valves and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
   1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, low voltage, and electrical work. Show locations of visible ceiling mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the work.
   2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, plumbing,fire protection, low voltage, and electrical equipment, and related work.
   3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, low voltage, and electrical equipment.
   4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
   5. Mechanical and Plumbing Work: Show the following:
      a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
      b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
      c. Fire-rated enclosures around ductwork.
   6. Electrical Work: Show the following:
      a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
      b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
      c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
      d. Location of pull boxes and junction boxes, dimensioned from column center lines.
   7. Fire-Protection System: Show the following:
      a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
   1. File Preparation Format: DXF operating in Microsoft Windows operating system.
   2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and supply Portable Data File (PDF) format.

2.04 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. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. 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.

G. 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.

H. Operation Manual
   1. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
      a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
      b. Performance and design criteria if Contractor has delegated design responsibility.
      c. Operating standards.

d. Operating procedures.
e. Operating logs.
f. Wiring diagrams.
g. Control diagrams.
h. Piped system diagrams.
i. Precautions against improper use.
j. License requirements including inspection and renewal dates.

2. Descriptions: Include the following:
   a. Product name and model number. Use designations for products indicated on Contract Documents.
   b. Manufacturer's name.
   c. Equipment identification with serial number of each component.
   d. Equipment function.
   e. Operating characteristics.
   f. Limiting conditions.
   g. Performance curves.
   h. Engineering data and tests.
   i. Complete nomenclature and number of replacement parts.
3. Operating Procedures: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Normal shutdown instructions.
   g. Seasonal and weekend operating instructions.
   h. Required sequences for electric or electronic systems.
   i. Special operating instructions and procedures.
4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

I. Maintenance Manuals
1. Content: Organize manual into a separate section for each product, system, subsystem, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
2. Source Information: List each product, system, or subsystem included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
3. Product Information: Include the following, as applicable:
   a. Product name and model number.
   b. Manufacturer's name.
   c. Color, pattern, and texture.
   d. Material and chemical composition.
   e. Reordering information for specially manufactured products.
   f. Standard maintenance instructions and bulletins.
   g. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   h. Identification and nomenclature of parts and components.
   i. List of items recommended to be stocked as spare parts.
4. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   a. Inspection procedures.

b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Schedule for routine cleaning and maintenance.
e. Repair instructions.
f. Test and inspection instructions.
g. Troubleshooting guide.
h. Precautions against improper maintenance.
i. Disassembly; component removal, repair, and replacement; and reassembly instructions.
j. Aligning, adjusting, and checking instructions.
k. Demonstration and training video recording, if available.

5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
6. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   a. Include procedures to follow and required notifications for warranty claims.
7. 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.
   a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
8. 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.
9. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
10. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    a. Include procedures to follow and required notifications for warranty claims.

PART 3 EXECUTION

3.01 CONTRACTOR'S SUBMITTAL 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. 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.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the Architect to forward to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

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 be returned by the Engineer without action.

3.03 CONSTRUCTION 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.
   3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 GENERAL COORDINATION FOR HVAC WORK

A. The Contractor shall compare the HVAC Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the HVAC Work. The HVAC Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the HVAC Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of pipes, ductwork, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.
   1. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. For example: plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
   2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, air vents, sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.
   3. Installation and Arrangement: The Contractor shall install all HVAC Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes, ducts, and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
   4. Ductwork: The Contractor shall change the cross-sectional dimensions of ductwork when required to meet job conditions but shall maintain at least the same equivalent cross-

sectional area. The Contractor shall secure the approval of the Engineer prior to fabrication of ductwork requiring such changes.

5. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, ducts. etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All piping connecting to equipment shall be installed without strain at the piping connection

G. Inaccessible Equipment
   1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination
   1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
   2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
   3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26. The Contractor shall coordinate between this Division and Division 26 to ensure that all disconnects required for the Project are furnished and installed.
   4. The Contractor of this Division shall furnish and install any low voltage relays, pressure switches, and similar items required for the proper operation of the HVAC equipment.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints. Provide 18 gauge (minimum) galvanized, 4 inch (minimum) deep drain pans under piping and ductwork located or passing

over electrical equipment. Pipe 1" drain from pan to nearest floor drain. Drain pan shall be adequately supported and constructed to hold 4 inches of water without collapse.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Pump shafts, fan shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.05 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.
   2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
   3. 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. 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.

C. 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. Proceed with patching after construction operations requiring cutting are complete.

D. 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.
      a. Clean piping and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   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.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

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.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
1. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Do not paint piping specialties with factory-applied finish.
5. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
6. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

END OF SECTION 23 0000

SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2022).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

B. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

1. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
2. Comply with MFMA-4.
3. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
    c. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D. Thermal Insulated Pipe Supports:
1. General Construction and Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
    c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
    d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F:
    a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
    b. Support From Below: MSS SP-58 Types 35 through 38.
2. Operating Temperatures from 122 to 446 degrees F:
    a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
    b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
    c. Sliding Support: MSS SP-58 Types 35 through 38.

F. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.

2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:
   1. Provide copper plated clamps for copper tubing support.
   2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

I. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
   1. Manufacturers:
      a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

J. Strut Clamps: Two-piece pipe clamp.
   1. Manufacturers:
      a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

K. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.
   1. Manufacturers:
      a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

L. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

M. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
   1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.

N. Pipe Alignment Guides: Galvanized steel.
   1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.

O. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

P. Pipe Shields for Insulated Piping:
   1. Manufacturers:
      a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Minimum Service Temperature: Minus 40 degrees F.
      e. Maximum Service Temperature: 178 degrees F.
      f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   4. Steel: Use beam clamps, machine bolts, or welded threaded studs.
   5. Sheet Metal: Use sheet metal screws.
   6. Plastic and lead anchors are not permitted.
   7. Powder-actuated fasteners are not permitted.
   8. Hammer-driven anchors and fasteners are not permitted.
   9. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

a. Comply with MFMA-4.
b. Channel Material: Use galvanized steel.
c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 23 0529

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.
   1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

1.02 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings; 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components; 2010, with Editorial Revision (2020).

F. MFMA-4 - Metal Framing Standards Publication; 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Seismic Controls:
      a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
      b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
   5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured.

1.05 SUBMITTALS

A. See Division 01 for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.
   1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
   2. Seismic Controls: Include seismic load capacities.

C. Shop Drawings - Vibration Isolation Systems:
   1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.

D. Shop Drawings - Seismic Controls:
   1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
   2. Identify mounting conditions required for equipment seismic qualification.
   3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
   4. Indicate proposed arrangement of distributed system trapeze support groupings.
   5. Indicate proposed locations for distributed system flexible fittings and/or connections.
   6. Indicate locations of seismic separations where applicable.

E. Seismic Design Data:
   1. Compile information on project-specific characteristics of actual installed HVAC components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
      a. Component operating weight and center of gravity.
      b. Component elevation in the building in relation to the roof elevation (z/h).
      c. Component importance factor (Ip).
      d. For distributed systems, component materials and connection methods.
      e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
      f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
   2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

F. Certification for seismically qualified equipment; identify basis for certification.

G. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

H. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

I. Evidence of qualifications for seismic controls designer.

J. Evidence of qualifications for manufacturer.

K. Manufacturer’s detailed field testing and inspection procedures.

L. Field quality control test reports.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:
   1. Select vibration isolators to provide required static deflection.
   2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
   3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
   4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
   5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Piping Isolation:
   1. Provide vibration isolators for piping supports:
      a. Located in equipment rooms.
      b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
      c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
   2. Minimum Static Deflection:
      a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
      b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
   3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
   4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
   5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
   6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
   7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

E. Thrust Restraint Applications:
   1. Use thrust restraints to resist horizontal motion due to thrust for fan heads, suspended fans, and base-mounted and suspended air handling equipment operating at 2.0 inches wg or greater total static pressure.
   2. Limit lateral movement to 0.25 inch or less unless otherwise indicated.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide HVAC component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC components.

B. Seismic Design Criteria: As indicated on the drawings. If information is not available on the drawings, the contractor will use the ASCE Hazzard Tool to determine. https://ascehazardtool.org.

C. Component Importance Factor (Ip): HVAC components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:
   1. HVAC components required to function for life safety purposes after an earthquake.
   2. HVAC components that support or otherwise contain hazardous substances.

D. Seismic Qualification of Equipment:
   1. Provide special certification for HVAC equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
   2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
   3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
   4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Premanufactured Modular HVAC Equipment: Where not otherwise seismically qualified, premanufactured modules 6 feet high and taller furnished under other sections to be designed in accordance with seismic provisions for nonbuilding structures.

F. Seismic Restraints:
   1. Provide seismic restraints for HVAC components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
   2. Seismic Restraint Exemptions:
      a. Exemptions for Seismic Design Category C:
         1) HVAC components where either of the following apply:
            (a) The component importance factor (Ip) is 1.0 and the component is positively attached to the structure.
            (b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
         2) HVAC piping with component importance factor (Ip) of 1.5 and nominal pipe size of 2 inch or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
      b. Duct System Exemptions, All Seismic Design Categories:
         1) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control with component importance factor (Ip) of 1.0, where flexible connections or other assemblies are provided between duct system and associated components, where duct system is positively attached to the structure, and where one of the following apply:
            (a) Trapeze supported duct with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point

connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.

(b) Trapeze supported duct with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 200 pounds or less.

(c) Trapeze supported duct with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, and the total weight supported by any single trapeze is 100 pounds or less.

(d) Hanger supported duct with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds or less.

2) Duct systems not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control, where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact, and where duct system is positively attached to the structure and has a cross sectional area of less than 6 square feet and weighs 20 pounds per foot or less.

c. HVAC Piping Exemptions, All Seismic Design Categories:

1) HVAC piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:

(a) Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet size requirements for exemption as single pipes described under specific seismic design category exemptions above.

(b) Trapeze supported piping with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.

(c) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 200 pounds or less.

(d) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.

(e) Hanger supported piping with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection to the supporting structure, where pipe has a component importance factor (Ip) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds or less.

3. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
4. Seismic Type Vibration Isolators:
    a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
5. External Seismic Snubber Assemblies:
    a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
    b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
6. Seismic Restraint Systems:
    a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
    b. Use only cable restraints to restrain vibration-isolated HVAC components, including distributed systems.
    c. Use only one restraint system type for a given HVAC component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
    d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC component in all lateral directions; consider bracket geometry in anchor load calculations.
    e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC component weight.
    f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC component weight.
    g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
    h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
    i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
7. Ductwork Applications:
    a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds.
    b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.

G. Seismic Attachments:
1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.

5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
    a. Increase size of pad as required to comply with anchor requirements.
    b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

H. Seismic Interactions:
1. Include provisions to prevent seismic impact between HVAC components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

I. Seismic Relative Displacement Provisions:
1. Use suitable fittings or flexible connections to accommodate:
    a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.
    b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
    c. Design displacements at seismic separations.
    d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:
1. Vibration-Isolated Equipment Support Bases:
2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration-Isolated Structural Steel Bases:
1. Description: Engineered structural steel frames with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Centrifugal Fan Applications: Provide adjustable motor slide rails as required.

C. Vibration-Isolated Concrete Inertia Bases:
1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 03 3000.
6. Centrifugal Fan Applications: Provide adjustable motor slide rails as required.
7. Pump Applications: Size and configure bases for piping elbow supports as required.

2.04 VIBRATION ISOLATORS

A. Manufacturers:
1. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:
1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
    a. Color code or otherwise identify springs to indicate load capacity.
    b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.

c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

3. Seismic Snubbing Elements for Seismic Isolators:
   a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Nonseismic Applications:
1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
   b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.

7. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
9. Thrust Restraints:
   a. Description: Assembly utilizing free-standing, laterally stable steel spring designed for resisting horizontal motion due to thrust (e.g., air pressure from a fan), and intended for installation in pairs.

D. Vibration Isolators for Seismic Applications:
1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for

seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:
   1. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:
   1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.06 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:
   1. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:
   1. Comply with ASCE 19.
   2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
   3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
   4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.
   1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
   2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:
   1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
   2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
   3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
   4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.
   5. Verification of required clearances between HVAC equipment, distribution systems, and associated supports and fire protection sprinkler system drops and sprigs for Seismic Design Categories C, D, E, and F; periodic inspection.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

D. Vibration Isolation Systems:
   1. Vibration-Isolated Equipment Support Bases:
      a. Provide specified minimum clearance beneath base.
   2. Spring Isolators:
      a. Position equipment at operating height; provide temporary blocking as required.
      b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
      c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
   3. Isolator Hangers:
      a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
      b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
   4. Thrust Restraints:
      a. Adjust restraint movement under normal operating static pressure.
   5. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
   6. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
   7. Adjust isolators to be free of isolation short circuits during normal operation.
   8. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

E. Seismic Controls:
   1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
   2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
   3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
   4. Equipment with Sheet Metal Housings:

a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. See Division 01 for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:
   1. Verify snubbing element air gaps.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 23 0548

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2025.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com

B. Brimar Industries, Inc: www.pipemarker.com

C. Craftmark Pipe Markers: www.craftmarkid.com

D. Seton Identification Products, a Tricor Direct Company: www.seton.com

E. Substitutions: See Section 016000-Product Requirements.

2.02 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Heat Transfer Equipment: Nameplates.

E. Instrumentation: Tags.

F. Major Control Components: Nameplates.

G. Rooftop Exhaust Fans: Nameplates.

H. Rooftop Units: Nameplates

I. Small-sized Equipment: Nameplates

J. Thermostats: Nameplates.

2.03 NAMEPLATES

A. Letter Color: Black.

B. Background Color: White.

C. Minimum Size: 3" x 1"

D. Rooftop Units and Air Handling Units Minimum Size: 6" x 3"

E. Plastic: Comply with ASTM D709.

2.04 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.05 PIPE MARKERS

A. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

B. Plastic Arrow Banding Tape: Flexible, vinyl film tape with pressure sensitive adhesive backing.
   1. Comply with ANSI / ASME A13.1 2020,

C. Color code as follows:
   1. Heating Water, Chilled Water, and Condensing Water: Green with white letters.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions. Include directional arrow banding.

D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 23 0553

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

C. Sound measurement of equipment operating conditions.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2024, with Errata (2025).

C. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2026.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.03 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
   1. Include at least the following in the plan:
      a. List of all air flow, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
      b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
      c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
      d. Final test report forms to be used.
      e. Procedures for formal deficiency reports, including scope, frequency and distribution.

B. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Revise TAB plan to reflect actual procedures and submit as part of final report.
   2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
   3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   5. Units of Measure: Report data in I-P (inch-pound) units only.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
   1. AABC (NSTSB), AABC National Standards for Total System Balance.
   2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Air coil fins are cleaned and combed.
   8. Access doors are closed and duct end caps are in place.
   9. Air outlets are installed and connected.
   10. Duct system leakage is minimized.
   11. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available toEngineer to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

E. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.07 SCOPE

A. Test, adjust, and balance the following:
   1. Packaged Roof Top Heating/Cooling Units.
   2. Air Coils.
   3. Air Handling Units.
   4. Fans.
   5. Air Terminal Units.
   6. Air Inlets and Outlets.
   7. Controls Compressor.

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Model/Frame.
   2. HP/BHP.

B. Cooling Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air DB temperature, design and actual.
   7. Entering air WB temperature, design and actual.
   8. Leaving air DB temperature, design and actual.
   9. Leaving air WB temperature, design and actual.
   10. Saturated suction temperature, design and actual.
   11. Air pressure drop, design and actual.

C. Heating Coils:
   1. Identification/number.
   2. Location.
   3. Service.
   4. Manufacturer.
   5. Air flow, design and actual.
   6. Entering air temperature, design and actual.
   7. Leaving air temperature, design and actual.
   8. Air pressure drop, design and actual.

D. Air Moving Equipment:
   1. Location.
   2. Manufacturer.
   3. Model number.

4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.

E. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

F. Exhaust Fans:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

G. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

H. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.

3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

I. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Design air flow.
6. Test (final) air flow.
7. Percent of design air flow.

J. Sound Level Reports:
1. Location.
2. Octave bands - equipment on.

END OF SECTION 23 0593

SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Jackets.

C. Outdoor weather-proof insulation.

D. Duct liner.

E. Fire barrier systems for kitchen exhaust duct.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2025.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 MANUFACTURES

A. Johns Manville[<>]: www.jm.com

B. Knauf Insulation; Atmosphere Duct Wrap: www.knaufinsulation.com

C. Owens Corning Corporation[<>]: www.ocbuildingspec.com

D. Substitutions: See Section016000-Product Requirements.

2.03 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K value: 0.29 at 75 degrees F @ Labeled Thickness, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Absorption: <5 percent by weight.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. K Value: 0.23 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: <2.0 percent by weight at 120 degrees F, 95% RH.
   4. Maximum Density: 3 lb/cu ft.

B. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.04 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.05 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

2.06 OUTDOOR WEATHER-PROOF INSULATION

A. Weather-Proof Outdoor Cladding
   1. Color: Submit color chart to architect.
   2. Density: 6,350 psi tensile strength
   3. Thermal Conductivity: K=0.146 BTU/in/ft2/hr./degree F
   4. R-Value = 8.1
   5. Temperature Limits: 165 degree F (exterior)
   6. Vapor Barrier: Autohesively bonded aluminum foil with zero permeability 1000 micron UV stable vinyl.
   7. Manufacturers:
      a. Thermanduct, LLC: www.thermaduct.com
      b. See Section 01 6000 - Product Requirements

2.07 DUCT LINER

A. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; rigid board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.
   1. Fungal Resistance: No growth when tested according to ASTM G21.
   2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
   3. Service Temperature: Up to 250 degrees F.
   4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

B. Adhesive: Waterproof, fire-retardant type, ASTM C916.

C. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

2.08 FIRE BARRIER SYSTEMS FOR KITCHEN EXHAUST DUCT

A. High temperature insulation blanket system.
   1. Material: High temperature soluble fiber blanket encapsulated in scrim reinforced foil.
   2. Type and Size: Roll 2 inches by 24 inches by 20 LF or 2 inches by 48 inches by 20 LF.
   3. Color: Aluminum silver.
   4. Weight: 1.33 lb/sq. ft.
   5. Surface Burning Characteristics (ASTM E-84):
   6. Combustibility (ASTM E-136): Noncombustible.
   7. Fire Resistance Shaft Rating equivalent to 2 hours.

B. Manufacturers:
   1. Unifrax: www.unifrax.com
   2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. External Duct Insulation Application: Glass Fiber, Flexible
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Ducts Exposed in Mechanical Equipment Rooms (below 10 feet above finished floor): Finish with aluminum jacket.

E. External Duct Insulation Application: Glass Fiber, Flexible
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
   6. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

F. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

G. Exterior Applications: Install outdoor weather-proof insulation system in strict accordance with manufacturer's instructions.

H. Fire Barrier System for Kitchen Exhaust: Install in strict accordance with manufacturer's instructions and as in tested assemblies.

3.03 SCHEDULES

A. Supply Ducts: 2" Glass Fiber, Flexible

B. Return Ducts: 2" Glass Fiber, Flexible

C. Outside Air Ducts: 2" Glass Fiber, Flexible

D. Exhaust Ducts Within 10ft of Exterior Openings" 2" Glass Fiber, Flexible

E. Ducts Exposed to Outdoors: 2" Glass Fiber, Rigid Insulation covered with Outdoor Weather-Proof Insulation System.

F. Kitchen Exhaust Duct: 2" High-Temperature Insulation

END OF SECTION 23 0713

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.

E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturers:

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

2.04 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation:Seston 2000 Series; www.jm.com
      b. Speedline: 25/50 Smoke-Safe PVC; www.speedline.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

F. Inserts and Shields:
   1. Application: Piping 1-1/2 inches diameter or larger.
   2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
   3. Insert location: Between support shield and piping and under the finish jacket.
   4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 15 feet above finished floor): Finish with colored PVC jacket and fitting covers.

H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Cooling Systems:
   1. Condensate Drains from Cooling Coils (Inside): 3/4" Cellular Foam Insulation
   2. Refrigerant Suction: 1" Cellular Foam Insulation
   3. Refrigerant Hot Gas: 1" Cellular Foam Insulation

END OF SECTION 23 0719

SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

G. HVAC control programs.

1.02 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h, with Editorial Revision (2022).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:
   1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
   2. List connected data points, including connected control unit and input device.
   3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.
   4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
   5. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

H. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

I. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

J. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Division 01 for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

D. Warranties to include all software updates and labor.

1.07 PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:
1. Limiting use of software to equipment provided under these specifications.
2. Limiting copying.
3. Preserving confidentiality.
4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Siemens

B. Trane

C. Allerton

D. Schneider

E. Pre-Approved Equal. See Division 01 for additional requirements.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Work Station:
   1. Resides on high speed network with building controllers.
   2. Connected to server for full access to all system information.

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

D. Hardware:
   1. Laptop:
      a. Laptop(s) to be provided by DDC controls manufacturer.
      b. Quantity: Provide allowance for 2 computer(s).
      c. Network Connection:
         1) Ethernet interface card.
   2. Hand Held Device:
      a. Provide remote system access via PDA with browser agnostic connectivity, including controller point monitor and control access to the following data:
         1) Alarm.
         2) Summary.
         3) Schedule.
         4) Trend.
      b. Provide the capability to view in text list based format.
      c. Minimum Functionality:
         1) Set point adjustment.
         2) Alarm acknowledgement.
         3) Scheduling.

2.04 CONTROLLERS

A. Building Controllers:
   1. General:
      a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
      b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
      c. Share data between networked controllers.
      d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
      e. Utilize real-time clock for scheduling.
      f. Continuously check processor status and memory circuits for abnormal operation.
      g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
      h. Communication with other network devices to be based on assigned protocol.
   2. Communication:
      a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
      b. Perform routing when connected to a network of custom application and application specific controllers.
      c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
   3. External Input-Output (I-O) Data Bus:
      a. Input only modules.
      b. Output only modules.

c. Variable frequency drives (VFD's).
d. Universal I-O module (configurable).
e. Access control module for single door.
f. Specific wired and wireless data integration modules.
g. DALI (Digital addressable lighting interface) modules.
h. Motor control of devices like blinds, roller shutters, and sun protection systems.
i. Multiple Input Output (I-O) Module:
1) IAQ: Temperature, humidity, and CO2.
2) Audio: Microphone, tone generator, and speaker.
3) Input and output terminals to monitor or control local devices.
4) Occupancy: Light and thermal sensing with multi-colored LED feedback.

4. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
2) Rated for operation at 40 to 150 degrees F.
b. Conditioned Space:
1) Mount within dustproof enclosures.
2) Rated for operation at 32 to 120 degrees F.

5. Provisions for Serviceability:
a. Diagnostic LEDs for power, communication, and processor.
b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

7. Power and Noise Immunity:
a. Maintain operation at 90 to 110 percent of nominal voltage rating.
b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:
1. General:
a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
b. Share data between networked, microprocessor based controllers.
c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
d. Utilize real-time clock for scheduling.
e. Continuously check processor status and memory circuits for abnormal operation.
f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
g. Communication with other network devices to be based on assigned protocol.

2. Communication:
a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:
a. Outdoors and/or in Wet Ambient Conditions:
1) Mount within waterproof enclosures.
2) Rated for operation at 32 to 120 degrees F..
b. Conditioned Space:
1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F.

4. Provisions for Serviceability:
   a. Diagnostic LED's for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:
1. General:
   a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
   b. Customized for operation within the confines of equipment served.
   c. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.
7. Smart Thermostat:
   a. Alphanumeric color display with button interface, white faceplate or fascia, multi-language support, surface or wall-mount over single gang box.
   b. Sensor: 1,000 ohm Platinum RTD within insulated thermoplastic enclosure.
   c. Temperature Control: Heating or cooling, On/Off control.
   d. Humidity Control: Dehumidification.
   e. Fan Control: ECM speed modulation.
   f. Primary Interface: ASHRAE Std 135 BACnet MS/TP communications.
   g. Certification: BACnet Testing Laboratory (BTL) certified device listed under the BACnet Smart Sensor (B-SS) device profile in compliance with ASHRAE Std 135.

D. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
    a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
    b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
    a. Allow monitoring of On/Off signals from remote devices.
    b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
    c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
    a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
    b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
    a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
    b. Outputs provided with three position (On/Off/Auto) override switches.
    c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
    a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
    b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
    c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
    a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
    b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
        1) VAV terminal units.
    c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
    a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
    b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:
1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.

5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.
8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:
1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.
2. Minimum surge protection attributes:
a. Dielectric strength of 1000 volts minimum.
b. Response time of 10 nanoseconds or less.
c. Transverse mode noise attenuation of 65 dB or greater.
d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.06 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.07 SYSTEM SOFTWARE

A. Operating System:
1. Concurrent, multi-tasking capability.
a. Common Software Applications Supported: Microsoft Excel.
2. System Graphics:
a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
b. Animation displayed by shifting image files based on object status.
c. Provide method for operator with password to perform the following:
1) Move between, change size, and change location of graphic displays.
2) Modify on-line.
3) Add, delete, or change dynamic objects consisting of:
(a) Analog and binary values.
(b) Dynamic text.
(c) Static text.
(d) Animation files.
3. Custom Graphics Generation Package:
a. Create, modify, and save graphic files and visio format graphics in PCX formats.
b. HTML graphics to support web browser compatible formats.
c. Capture or convert graphics from AutoCAD.
4. Standard HVAC Graphics Library:

a. HVAC Equipment:
    1) Air Handlers.
    2) Fan Coil Units.
    3) Others as indicated on drawings
b. Ancillary Equipment:
    1) Fans.
    2) Coils.
    3) Valves.
    4) Piping.
    5) Dampers.
    6) Others as indicated on drawings
c. File Format Compatible with Graphics Generation Package Program.

B. Workstation System Applications:
1. Automatic System Database Save and Restore Functions:
    a. Current database copy of each Building Controller is automatically stored on hard disk.
    b. Automatic update occurs upon change in any system panel.
    c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
    a. Save database from any system panel.
    b. Clear a panel database.
    c. Initiate a download of a specified database to any system panel.
3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
4. On-line Help:
    a. Context-sensitive system assists operator in operation and editing.
    b. Available for all applications.
    c. Relevant screen data provided for particular screen display.
    d. Additional help available via hypertext.
5. Security:
    a. Operator log-on requires user name and password to view, edit, add, or delete data.
    b. System security selectable for each operator.
    c. System supervisor sets passwords and security levels for all other operators.
    d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
    e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
    f. All system security data stored in encrypted format.
6. System Diagnostics:
    a. Operations Automatically Monitored:
        1) Workstations.
        2) Modems.
        3) Network connections.
        4) Building management panels.
        5) Controllers.
    b. Device failure is annunciated to the operator.
7. Alarm Processing:
    a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
    b. Configurable Objects:

1) Alarm limits.
2) Alarm limit differentials.
3) States.
4) Reactions for each object.

8. Alarm Messages:
   a. Descriptor: English language.
   b. Recognizable Features:
      1) Source.
      2) Location.
      3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:
   a. Logging.
   b. Printing.
   c. Starting programs.
   d. Displaying messages.
   e. Dialing out to remote locations.
   f. Paging.
   g. Providing audible annunciation.
   h. Displaying specific system graphics.
10. Custom Trend Logs:
   a. Definable for any data object in the system including interval, start time, and stop time.
   b. Trend Data:
      1) Sampled and stored on the building controller panel.
      2) Archivable on hard disk.
      3) Retrievable for use in reports, spreadsheets and standard database programs.
      4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
      5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
   a. View all system alarms and change of states from any system location.
   b. Events listed chronologically.
   c. Operator with proper security acknowledges and clears alarms.
   d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
   a. Provide a method to view, edit if applicable, the status of any object and property in the system.
   b. Status Available by the Following Methods:
      1) Menu.
      2) Graphics.
      3) Custom Programs.
13. Reports and Logs:
   a. Reporting Package:
      1) Allows operator to select, modify, or create reports.
      2) Definable as to data content, format, interval, and date.
      3) Archivable to hard disk.
   b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
   c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
   d. Set to be printed on operator command or specific time(s).
14. Reports:
   a. Standard:

1) Objects with current values.
2) Current alarms not locked out.
3) Disabled and overridden objects, points and SNVTs.
4) Objects in manual or automatic alarm lockout.
5) Objects in alarm lockout currently in alarm.
6) Logs:
(a) Alarm History.
(b) System messages.
(c) System events.
(d) Trends.

b. Custom:
1) Daily.
2) Weekly.
3) Monthly.
4) Annual.
5) Time and date stamped.
6) Title.
7) Facility name.

c. Tenant Override:
1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:
1) Electrical Meter(s):
(a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
(b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
2) Fuel Meter(s):
(a) Monthly showing daily natural gas consumption for each meter.
(b) Annual summary showing monthly consumption for each meter.
3) Weather:
(a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

C. Workstation Applications Editors:
1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
a. Configuration.
b. Name.
c. Control parameters.
d. Set-points.
4. Scheduling:
a. Monthly calendar indicates schedules, holidays, and exceptions.
b. Allows several related objects to be scheduled and copied to other objects or dates.
c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:
a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.
b. Programming Features:
1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.

2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.
3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.
4) Allows the development of independently, executing, program modules designed to enable and disable other modules.
5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.
6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.
7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.
8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.
9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.08 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

B. System Security:
   1. User access secured via user passwords and user names.
   2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
   3. User Log On/Log Off attempts are recorded.
   4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:
   1. Weekly Schedules Based on Separate, Daily Schedules:
      a. Include start, stop, optimal stop, and night economizer.
      b. 10 events maximum per schedule.
      c. Start/stop times adjustable for each group object.
   2. Exception Schedules:
      a. Based on any day of the year.
      b. Defined up to one year in advance.
      c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
   3. Holiday or Special Schedules:
      a. Capability to define up to 99 schedules.
      b. Repeated annually.
      c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. Alarms:
   1. Binary object is set to alarm based on the operator specified state.
   2. Analog object to have high/low alarm limits.
   3. All alarming is capable of being automatically and manually disabled.
   4. Alarm Reporting:
      a. Operator determines action to be taken for alarm event.

b. Alarms to be routed to appropriate workstation.
c. Reporting Options:
1) Start programs.
2) Logged.
3) Custom messaging.
4) Graphical displays.
5) Dial out to workstation receivers via system protocol.

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. PID Control Characteristics:
1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

H. Staggered Start Application:
1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

I. Energy Calculations:
1. Accumulated instantaneous power or flow rates are converted to energy use data.
2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.

J. Anti-Short Cycling:
1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

K. On-Off Control with Differential:
1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

L. Run-Time Totalization:
1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.09 HVAC CONTROL PROGRAMS

A. General:
1. Support Inch-pounds and SI (metric) units of measurement.
2. Identify each HVAC Control system.

B. Optimal Run Time:
1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
a. Define term schedule.
b. Add/delete fan status point.

c. Add/delete outside air temperature point.
d. Add/delete mass temperature point.
e. Define heating/cooling parameters.
f. Define mass sensor heating/cooling parameters.
g. Lock/unlock program.
h. Request optimal run time control summary.
i. Request optimal run time mass temperature summary.
j. Request HVAC point summary.
k. Request HVAC saving profile summary.

7. Control Summary:
   a. HVAC Control system begin/end status.
   b. Optimal run time lock/unlock control status.
   c. Heating/cooling mode status.
   d. Optimal run time schedule.
   e. Start/Stop times.
   f. Selected mass temperature point ID.
   g. Optimal run time system normal start times.
   h. Occupancy and vacancy times.
   i. Optimal run time system heating/cooling mode parameters.
8. Mass temperature summary:
   a. Mass temperature point type and ID.
   b. Desired and current mass temperature values.
   c. Calculated warm-up/cool-down time for each mass temperature.
   d. Heating/cooling season limits.
   e. Break point temperature for cooling mode analysis.
9. HVAC point summary:
   a. Control system identifier and status.
   b. Point ID and status.
   c. Outside air temperature point ID and status.
   d. Mass temperature point ID and point.
   e. Calculated optimal start and stop times.
   f. Period start.

C. Supply Air Reset:
1. Monitor heating and cooling loads in building spaces, terminal reheat systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
   a. Raising cooling temperatures to highest possible value.
   b. Reducing heating temperatures to lowest possible level.
3. Operator commands:
   a. Add/delete fan status point.
   b. Lock/unlock program.
   c. Request HVAC point summary.
   d. Add/Delete discharge controller point.
   e. Define discharge controller parameters.
   f. Add/delete air flow rate.
   g. Define space load and load parameters.
   h. Request space load summary.
4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.

e. High/low limits.
f. Deadband.
g. Response timer.
h. Reset times.

5. Space load summary:
   a. HVAC system status.
   b. Optimal run time status.
   c. Heating/cooling loop status.
   d. Space load point ID.
   e. Current space load point value.
   f. Control heat/cool limited.
   g. Gain factor.
   h. Calculated reset values.
   i. Fan status point ID and status.
   j. Control discharge temperature point ID and status.
   k. Space load point ID and status.
   l. Air flow rate point ID and status.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.

C. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Provide conduit and electrical wiring in accordance with Division 26. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C. Provide basic operator training for 5 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.05 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

END OF SECTION 23 0923

SECTION 23 0934
VARIABLE-FREQUENCY MOTOR CONTROLLERS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

1.02 RELATED REQUIREMENTS

A. Section 23 0529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

C. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

D. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

E. NEMA IS 10033 - Industrial Control and Systems: Adjustable-Speed Drives; 2026.

F. NEMA IS 10034 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable Speed Drive Systems; 2022 (Reapproved 2025).

G. NEMA IS 10035 - Application Guide for AC Adjustable Speed Drive Systems; 2021 (Reaffirmed 2025).

H. NEMA MG 00001 - Motors and Generators; 2024.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide motor controllers suitable for use with actual motors to be installed.
   2. Coordinate work to provide controllers and associated wiring suitable for interface with control devices to be installed.
   3. Coordinate arrangement with dimensions and clearance requirements of actual equipment to be installed.
   4. Verify with manufacturer that conductor terminations are suitable for use with conductors to be installed.
   5. Notify Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum 1 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB; www.abb.com.

B. Danfoss; www.danfoss.com.

C. Siemens; www.siemens.com

D. Yaskawa: www.yaskawa.com.

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA IS 10033, NEMA IS 10034, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA IS 10035, NEMA MG 00001 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:
   1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 00001 design letter or inverter duty rating for induction motors.
   2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
   3. Motor nameplate data.
   4. Requirements for speed control range, speed regulation, and braking.
   5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:
   1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
   2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
   3. Efficiency: Minimum of 96 percent at full speed and load.
   4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
   5. Overload Rating:
      a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
      b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
   1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.

H. Control System:

1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
    a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
        1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
        2) Vector Control: Provide selectable autotuning function.
    b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
    c. Selectable braking control; DC injection or flux braking.
    d. Adjustable minimum/maximum speed limits.
    e. Adjustable pulse width modulation switching carrier frequency.
    f. Adjustable motor slip compensation.
    g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
4. Status Indications:
    a. Motor run/stop status.
    b. Motor forward/reverse status.
    c. Local/remote control status.
    d. Output voltage.
    e. Output current.
    f. Output frequency.
    g. DC bus voltage.
    h. Motor speed.
5. Protective Functions/Alarm Indications:
    a. Overcurrent.
    b. Motor overload.
    c. Undervoltage.
    d. Overvoltage.
    e. Controller overtemperature.
    f. Input/output phase loss.
    g. Output short circuit protection.
    h. Output ground fault protection.
6. Inputs:
    a. Digital Input(s): Three.
    b. Analog Input(s): Two.
7. Outputs:
    a. Analog Output(s): One.
    b. Relay Output(s): Two.
8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
    a. Remote Monitoring Capabilities:
9. Features:
    a. Password-protected security access.
    b. Event log.

I. Power Conditioning/Filtering:

1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
1. Disconnects: Circuit breaker or disconnect switch type.
a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.

K. Service Conditions:
1. Provide controllers and associated components suitable for operation under following service conditions without derating:
a. Altitude: Less than 3,300 feet.
b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

L. Short Circuit Current Rating:
1. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
1. Comply with NEMA IA 10030.
2. NEMA EN 10250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install in accordance with NEMA IS 10034 and manufacturer's instructions.

C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 23 0529.

F. Install controllers plumb and level.

G. Provide grounding and bonding.

H. Install field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

SECTION 23 1123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 33 5216 - Gas Hydrocarbon Piping.

1.03 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing; 2023.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

C. ANSI Z223.1 - National Fuel Gas Code; 2024.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

E. ASME B31.1 - Power Piping; 2018.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

H. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2019.

I. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.

J. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

K. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends; 2011.

L. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ANSI Z223.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.
   4. Mechanical Press Sealed Fittings: Double pressed type and approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Apollo Valves: www.apollovalves.com
         2) Viega LLC; MegaPress: www.viega.us
         3) Or Approved Equal: See Division 01 for additional requirements.

B. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC1 / CSA 6.26.
   2. Fittings: Provided by piping system manufacturer.
   3. Manufacturers:
      a. Omega Flex, Inc; TracPipe PS-II: www.omegaflex.com
      b. Or Approved Equal; See Division 01 for additional requirements.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.
   3. Mechanical Press Sealed Fittings: Double pressed type and approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Apollo Valves: www.apollovalves.com
         2) Viega LLC; MegaPress: www.viega.us
         3) Or Approved Equal; See Division 01 for additional requirements.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.04 BALL VALVES

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com
   2. Nibco, Inc: www.nibco.com
   3. Viega LLC: www.viega.us
   4. Or Approved Equal: See Division 01 for additional requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze body, chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle, threaded ends with union.

2.05 STRAINERS

A. Manufacturers:
   1. Armstrong International, Inc: www.armstronginternational.com
   2. Green Country Filter Manufacturing: www.greencountryfilter.com
   3. WEAMCO: www.weamco.com
   4. Or Approved Equal: See Division 01 for additional requirements.

B. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

2.06 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:
   1. Actaris Metering Systems (A brand of ITT Controls): www.actaris-metering-systems.com/#sle.
   2. Maxitrol Company: www.maxitrol.com/#sle.
   3. Sensus.
   4. Or Approved Equal: See Division 01 for additional requirements.

B. Compliance Requirements:
   1. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

C. Materials in Contact With Gas:
   1. Housing: Aluminum, steel (free of non-ferrous metals).
   2. Seals and Diaphragms: NBR-based rubber.

D. Maximum Inlet Operating Pressure: 10 psi.
   1. Line Pressure Regulator: 10 psi.

E. Maximum Body Pressure: 10 psi.

F. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

F. Provide access where valves and fittings are not exposed.

G. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

H. Provide support for utility meters in accordance with requirements of utility companies.

I. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. **All exposed gas piping (interior and exterior) shall be painted yellow and properly labeled.**

J. Install valves with stems upright or horizontal, not inverted.

K. Sleeve pipes passing through partitions, walls and floors.

L. Pipe Hangers and Supports:

1. Support horizontal piping as indicated. Refer to Section 230529.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Provide plug valves in natural gas systems for shut-off service.

3.05 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 5216. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Filter-driers.

E. Engineered wall seals and insulation protection.

F. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 0719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024, with Addendum (2025).

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

C. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

E. ASME B31.9 - Building Services Piping; 2025.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

G. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

H. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

I. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

1.04 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

2.02 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.
   1. Fittings: ASME B16.22 wrought copper.

2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Supports and Anchors:
   1. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   2. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

D. Refrigerant: R-410A as defined in ASHRAE Std 34.

E. Refrigerant: R-32 as defined in ASHRAE Std 34.

F. Refrierant: R-454B as defined in ASHRAE Std 34.

2.03 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 FILTER-DRIERS

1. Flow Capacity - Liquid Line: (Refer to schedules) ton, minimum, rated in accordance with AHRI 710.

2.05 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Outlet Cover Color: Gray.

B. Insulation Protection System: Mechanical line insulation and PVC cover.
   1. PVC Insulation Cover Color: Black with full-length velcro fastener.
   2. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
   3. Water/Vapor Permeability: Comply with ASTM E96/E96M.

2.06 EXTERIOR PENETRATION ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

G. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

I. Insulate piping; refer to Section and Section 23 0716.

J. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

END OF SECTION 23 2300

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Kitchen hood ductwork.

1.02 RELATED REQUIREMENTS

A. Section 23 0713 - Duct Insulation: External insulation and duct liner.

B. Section 23 3700 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials and duct connections.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply: 2 inch w.g. pressure class, galvanized steel.

D. Return and Relief: 2" inch w.g. pressure class, galvanized steel.

E. General Exhaust: 2" inch w.g. pressure class, galvanized steel.

F. Kitchen Cooking Hood Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
   1. Construct of 18 gage, 0.0500 inch stainless steel using continuous external welded joints in rectangular sections.

G. Dishwasher Exhaust: 1/2 inch w.g. pressure class, galvanized steel.
   1. Construct of 18 gage, 0.0500 inch stainless steel using continuous external welded joints in rectangular sections.

H. Grease Exhaust: 1/2 inch w.g. pressure class, stainless steel.

I. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Rectangular Ductwork: Shall conform to SMACNA HVAC Duct Construction Standards, Metal and Flexible or SMACNA Rectangular Industrial Duct Construction Standards.
   1. Cross-Breaking:
      a. Sheet metal ducts and fittings over 19" wide be beaded, cross-broken, or otherwise stiffened, to eliminate oil canning or vibration.
      b. Vertical and horizontal sheet metal barriers, duct offsets, and elbows 19" wide or larger shall be cross-broken.
      c. 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.
   2. Radius Elbows: Radius elbows with a rectangular cross section shall have a centerline radius of not less than the width of the duct or shall be furnished with single thickness splitter vanes. A single splitter vane shall be used for elbows with a ratio of inside radius to duct width of 0.5 to 0.2. Two splitter vanes shall be used for ratios less than 0.20.
   3. Square Elbows: Square elbows shall be equipped with either single or double thickness turning vanes, with a radius of 4.5", and a separation of 3.25", pre-assembled on runners constructed per SMACNA Accepted Industry Practice for Industrial Duct Design. Vanes shall be securely attached to the runners. Vanes shall be welded to the runners in systems with pressures greater than 6" w.g. or velocities greater than 3000 FPM. The maximum unsupported length of vanes shall be 36".

B. Round Ducts: Round lockseam duct with galvanized steel outer wall.
   1. Manufacture in accordance with SMACNA (DCS).

C. Acoustic Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
   1. Insulation: 2" Fiberglass insulation with reinforced vapor barrier.
   2. Inner Core: Spun-bonded, non-woven inner core.
   3. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative. (4"-12" ID)
   4. Maximum Velocity: 5,000 fpm.']
   5. Temperature Range: Minus 20 degrees F to 210 degrees F.

D. Kitchen Cooking Hood and Grease Exhaust: Nominal 3 inches thick ceramic fiber insulation between 20 gage, 0.0375 inch, Type 304 stainless steel liner and 24 gage, 0.0239 inch aluminized steel sheet outer jacket.
   1. Tested and UL listed for use with commercial cooking equipment in accordance with NFPA 96.

E. Dishwasher Exhaust: Minimum 21 gage, 0.0344 inch thick, single wall, Type 304 stainless steel.
   1. Joints to be sealed during installation with factory supplied overlapping V-bands and sealant.

2.05 KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with ductwork manufacturer's installation instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with liquid adhesive plus tape.

E. Kitchen Hood Exhaust: Provide residue traps at base of vertical risers with provisions for clean out.

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Connect diffusers plenum boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

I. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

END OF SECTION 23 3100

SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Duct access doors.

C. Duct test holes.

D. Fire dampers.

E. Flexible duct connectors.

F. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

C. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.02 DUCT ACCESS DOORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.

3. Up to 24 by 48 inches: Three hinges and two compression latches with outside and inside handles.

2.03 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

C. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

2.04 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
   1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
      a. Net Fabric Width: Approximately 3 inches wide.
   2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.05 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers:
   1. Fabricate for duct sizes up to 6 by 30 inch.
   2. Blade: 24 gage, 0.0239 inch, minimum.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
   1. Blade: 18 gage, 0.0478 inch, minimum.

D. Quadrants:
   1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
   2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
   3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

B. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. Provide fire dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Demonstrate re-setting of fire dampers to Owner's representative.

F. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 23 3300

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling exhaust fans.

B. Kitchen hood upblast roof exhausters.

1.02 REFERENCE STANDARDS

A. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com

B. Greenheck Fan Corporation: www.greenheck.com

C. Loren Cook Company: www.lorencook.com

D. CaptiveAire: www.captiveaire.com

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

C. Grille: Aluminum with custom color finish.

2.03 KITCHEN HOOD UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
   2. Statically and dynamically balanced.
   3. Motors:
      a. Open drip-proof (ODP).
      b. Fully accessible for maintenance.
   4. Housing:

a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
b. Rigid internal support structure to support duct running across the roof before penetrating.
c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
d. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:
1. Fan Shaft:
a. Ground and polished steel with anti-corrosive coating.
b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
a. Permanently sealed or pillow block type.
b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
c. 100 percent factory tested.

C. Drive Assembly:
1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
3. Motor pulley adjustable for final system balancing.
4. Readily accessible for maintenance.

D. Disconnect Switches:
1. Factory mounted and wired.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
3. Positive electrical shutoff.
4. Wired from fan motor to junction box installed within motor compartment.

E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

D. Install backdraft dampers on inlet to roof and wall exhausters.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION 23 3423

SECTION 23 3439
HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 2 PRODUCTS

1.01 GENERAL REQUIREMENTS

A. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 507.

B. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.02 HIGH-VOLUME, LOW-SPEED PROPELLER FANS

A. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

END OF SECTION 23 3439

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

B. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com

B. Price Industries: www.price-hvac.com

C. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com

D. Tuttle and Bailey: www.tuttleandbailey.com

E. Pacific Registers .

F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DIFFUSERS AND GRILLES

A. **Refer to schedules on the drawings.**

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

SECTION 23 3813
COMMERCIAL-KITCHEN HOODS

PART 2 PRODUCTS

1.01 HOOD APPLICATIONS

1.02 HOOD CONSTRUCTION

A. Provide products that comply with NFPA 96, the requirements and recommendations of SMACNA (KVS), and the requirements of the Authorities Having Jurisdiction.

B. Construction: Materials, inside and out, are stainless steel complying with ASTM A666/A666M, Type 304, stretcher leveled; unless otherwise indicated.
   1. Sheet Thickness: 18 gauge, 0.048 inch, minimum.
   2. Fabrication: Fabricate each individual hood in one piece, with all welds ground and finished to match (inside and out); fabricate flat surfaces exposed to view as double-pan formed panels with internal stiffener members.
   3. Finish on Surfaces Exposed to View: No.4 (brushed directional); provide stainless steel faces on all sides exposed to view.
   4. Finish on Concealed Surfaces: No.4 or No.2B (dull, matte).
   5. Duct Collars: For exhaust and make-up air openings, provide duct collar welded to hood unit; minimum of 8 inches extension from top or back face of unit, with minimum one inch 90 degree flange, unless otherwise indicated.
   6. Access Panels: Provide removable or hinged access panels sufficient for maintenance and replacement of operating components inside unit; maximum width of 40 inches.
   7. Supports: Stainless steel mounting brackets, struts, and threaded hanger rods.
      a. Hanger Rods: 3/8 inch diameter, minimum.
      b. Hanger Spacing: 48 inches on center, maximum.
      c. Attachment to Structure: Mechanical fittings or inserts, stainless steel.

C. Make-Up Air System: Provide volume damper at inlet, accessible for balancing.

1.03 HOOD ACCESSORIES

A. Fire Extinguishing Systems:
   1. Fire extinguishing system to comply with NFPA 96.
   2. Exposed Piping Under Hood: Stainless steel or chrome plated.
   3. Exposed Piping Outside Hood: Not permitted.
   4. Nozzles: Stainless steel or chrome plated brass.
   5. Electrical Components: Provide all components required for properly operating system, including but not limited to wiring, raceways, contactors, circuit breakers, switches and solenoids.
   6. Manual Actuators: Wall-mounted pull stations; provide one near each hood and one near exit door.

B. Controls:
   1. Fans: Provide manual push button controls for starting and stopping fans and labeled indicator lights showing fan status.
   2. Fans: Provide controls for fan operation by time clock, programmable by the week, capable of maintaining time cycle after operation of manual push buttons.
   3. Fire Extinguishing System: Provide automatic actuation complying with NFPA 96; provide local and remote manual actuating stations clearly labeled "Hood Fire Protection"; upon actuation of fire extinguishing system, automatically:
      a. Shut off fans serving that hood.
      b. Signal building fire alarm system; normally-open contacts.

C. Control Panels: Factory assembled and pre-wired, ready for utility connections.
   1. UL listed for use with specific hood.

2. Provide a single control panel combining all control functions for a particular hood, unless otherwise indicated.
3. Provide a single control panel for each group of hoods served by a single exhaust fan.
4. Enclosures: Flush-mounted; stainless steel, to match hood.
5. Provide indicator lights on control panel door showing status of fans and power supply.

D. Lights Inside Hoods: Fluorescent and incandescent in quantity and locations indicated, in UL listed vapor-proof fixtures, pre-wired to junction box on top of hood.
1. Locate switch for operating lights in locations indicated.

END OF SECTION 23 3813

SECTION 23 7416
PACKAGED ROOFTOP AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged, intermediate-capacity, rooftop air-conditioning units.

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 SUBMITTALS

A. See Division 01 for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Captive-Aire

B. Greenheck

C. Trane Technologies, PLC: www.trane.com

D. Substitutions: Per Division 01.

E. _____.

2.02 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration that are 7.5 tons to 25 tons in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

C. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) no greater than that allowed by federal code.

D. Disconnect Switch: Factory mount disconnect switch in control panel.

2.03 CASING

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Structural members to be minimum 18 gauge, 0.0478 inch, with access doors or panels of minimum 20 gauge, 0.0359 inch.

2.04 FANS

A. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch pulley, and rubber isolated hinge mounted. Provide with high efficiency motor or direct drive as indicated. Isolate complete fan assembly. See Section 23 0548.

2.05 BURNERS

A. Gas Burner: Atmospheric type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame-sensing device, and automatic 100 percent shutoff pilot.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

2.06 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.07 COMPRESSORS

A. Provide Inverter Scroll compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.08 AIR FILTERS:

A. 2-inch thick, glass fiber disposable media in metal frames.

2.09 OPERATING CONTROLS

A. Provide low voltage, adjustable room thermostat to control burner operation, compressor and condenser fan, and supply fan to maintain temperature setting.
   1. Include system selector switch heat-off-cool and auto-on fan control switch.
   2. Locate thermostat in room as indicated on drawings.

B. Provide remote-mounted auto-on fan control switch.

2.10 ROOF CURBS

A. Roof Mounting Curb: 14 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that the space is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

END OF SECTION 23 7416

SECTION 23 8126.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor air handling (fan and coil) units for ducted systems.

C. Indoor air handling (fan and coil) units for ductless systems.

D. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant; 2019.

E. NEMA MG 00001 - Motors and Generators; 2024.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2027.

H. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C. Design Data: Indicate refrigerant pipe sizing.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. LG

B. Trane Inc: www.trane.com

C. Daikin:

D. Carrier

E. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.03 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Horizontal.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
   1. Motor: NEMA MG 1; 1750 rpm multiple speed, permanently lubricated, hinge mounted.

C. Air Filters: MERV 8 thick glass fiber, disposable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2.04 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
   1. Cabinet: Galvanized steel.
      a. Finish: White.
   2. Fan: Line-flow fan direct driven by a single motor.
   3. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2.05 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Comply with AHRI 210/240.
   2. Refrigerant: R-32.
   3. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   4. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Compressor: Scroll, modulating 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
   1. Condenser Fans: Direct-drive propeller type.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

F. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting. Refer to controls sequence on the drawings for specific design.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.06 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. Thermostat Display:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

D. Pipe drain from humidifiers to nearest floor drain or as shown on the drawings.

END OF SECTION 23 8126.13

SECTION 23 8129
VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Variable refrigerant volume HVAC system includes:
   1. Outdoor/condensing unit(s).
   2. Indoor/evaporator units.
   3. Branch selector units.
   4. Refrigerant piping.
   5. Control panels.
   6. Control wiring.

1.02 RELATED REQUIREMENTS

A. Section 23 0800 - Commissioning of HVAC.

B. Section 23 2300 - Refrigerant Piping: Additional requirements for refrigerant piping system.

C. Section 26 0583 - Wiring Connections: Power connections to equipment.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008, Including All Addenda.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

PART 2 PRODUCTS

2.01 HVAC SYSTEM DESIGN

A. System Operation: Heating and cooling, simultaneously.
   1. Zoning: Provide capability for temperature control for each individual indoor/evaporator unit independently of all other units.
   2. Zoning: Provide heating/cooling selection for each individual indoor/evaporator unit independently of all other units.
   3. Provide a complete functional system that achieves the specified performance based on the specified design conditions and that is designed and constructed according to the equipment manufacturer's requirements.
   4. Conditioned spaces are indicated on drawings.
   5. Branch selector unit locations are not indicated on drawings.
   6. Required equipment unit capacities are indicated on drawings.
   7. Refrigerant piping sizes are not indicated on drawings.
   8. Connect equipment to condensate piping provided by others; condensate piping is indicated on drawings.

B. Cooling Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 57 degrees F to 77 degrees F.
   3. Night Setback: 78 degrees F.
   4. Interior Relative Humidity: 20 percent, maximum.

C. Heating Mode Interior Performance:
   1. Daytime Setpoint: 68 degrees F, plus or minus 2 degrees F.
   2. Setpoint Range: 59 degrees F to 80 degrees F.
   3. Night Setback: 60 degrees F.
   4. Interior Relative Humidity: 10 percent, minimum.

D. Outside Air Design Conditions:

E. Energy Design Wind Speed: 25 mph.

F. Operating Temperature Ranges:
   1. Simultaneous Heating and Cooling Operating Range: minus 4 degrees F to 60 degrees F dry bulb.
   2. Cooling Mode Operating Range: minus 4 degrees F to 110 degrees F dry bulb.
   3. Heating Mode Operating Range: 0 degrees F to 77 degrees F dry bulb; minus 4 degrees F to 60 degrees F wet bulb; without low ambient controls or auxiliary heat source.

G. Refrigerant Piping Lengths: Provide equipment capable of serving system with following piping lengths without any oil traps:
   1. Minimum Piping Length from Outdoor/Central Unit(s) to Furthest Terminal Unit: 540 feet, actual; 620 feet, equivalent.
   2. Total Combined Liquid Line Length: 3280 feet, minimum.
   3. Minimum Piping Length Between Indoor Units: 49 feet.

H. Control Wiring Lengths:
   1. Between Outdoor/Condenser Unit and Indoor/Evaporator Unit: 6,665 feet, minimum.
   2. Between Outdoor/Condenser Unit and Central Controller: 3,330 feet, minimum.
   3. Between Indoor/Evaporator Unit and Remote Controller: 1,665 feet.

I. Controls: Provide the following control interfaces:

2.02 EQUIPMENT

A. All Units: Factory assembled, wired, and piped and factory tested for function and safety.
   1. Performance Certification: AHRI Certified; www.ahrinet.org.
   2. Safety Certification: Tested to UL 1995 by UL or Intertek-ETL, listed in ITS (DIR), and bearing the certification label.
   3. Provide outdoor/condensing units capable of serving indoor unit capacity up to 200 percent of the capacity of the outdoor/condensing unit.
   4. Provide units capable of serving the zones indicated.
   5. Thermal Performance: Provide heating and cooling capacity as indicated, based on the following nominal operating conditions:
   6. Energy Efficiency: Report EER and COP based on tests conducted at “full load” in accordance with AHRI 210/240 or alternate test method approved by U.S. Department of Energy.

B. Electrical Characteristics:
   1. Power - Branch Selector Units: 208 to 230 Volts, single phase, 60 Hz.
   2. Power - Indoor Units: 208 to 230 Volts, single phase, 60 Hz.
   3. 208-230 Voltage Range: 187 to 253 volts.

C. Refrigerant Piping:
   1. Insulate each refrigerant line individually between the condensing and indoor units.

2.03 OUTDOOR/CONDENSING UNITS

A. Outdoor/Condensing Units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronic and refrigerant controls; modular design for ganging multiple units.
   1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut off valves, oil separators, service ports and refrigerant regulator.
   2. Refrigerant: Factory charged.
   3. Variable Volume Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressures while varying refrigerant volume to suit heating/cooling loads.
   4. Capable of being installed with wiring and piping to the left, right, rear or bottom.

5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted, due to potential reduction in space temperature.
6. Sound Pressure Level: As specified, measured at 3 feet from front of unit; provide night setback sound control as a standard feature; three selectable sound level steps of 55 dB, 50 dB, and 45 dB, maximum.
7. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.
8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-recycling timers.
9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying to us indoor units.
10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.
11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.
   1. Designed to allow side-by-side installation with minimum spacing.

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (digitally commutating) inverter.
   1. Provide minimum of 2 fans for each condensing unit.
   2. External Static Pressure: Factory set at 0.12 in WG, minimum.
   3. Indoor Mounted Air-Cooled Units: External static pressure field set at 0.32 in WG, minimum; provide for mounting of field-installed ducts.
   4. Fan Airflow: As indicated for specific equipment.
   5. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form mechanical bond; waffle louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven and fixed speed in combination to suit total capacity; minimum of one variable speed, inverter driven compressor per condenser unit; minimum of two compressors per condenser unit; capable of controlling capacity within range of 6 percent to 100 percent of total capacity.
   1. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return, and completion of defrost, or every 8 hours.
   2. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.
   3. Provide each compressor with crankcase heater, high pressure safety switch, and internal thermal overload protector.
   4. Provide oil separators and intelligent oil management system.
   5. Provide spring mounted vibration isolators.

2.04 BRANCH SELECTOR UNITS

A. Branch Selector Units: Concealed boxes designed specifically for this type of system to control heating/cooling mode selection of downstream units; consisting of electronic expansion valves, subcooling heat exchanger, refrigerant control piping and electronics to facilitate communications between unit and main processor and between branch unit and indoor/evaporator units.

1. Control direction of refrigerant flow using electronic expansion valves; use of solenoid valves for changeover and pressure equalization is not permitted due to refrigerant noise; use of multi-port branch selector boxes is not permitted unless spare ports are provided for redundancy.
2. Provide one electronic expansion valve for each downstream unit served, except multiple indoor/evaporator units may be connected, provided balancing joints are used in downstream piping and total capacity is within capacity range of the branch selector.
3. When branch unit is simultaneously heating and cooling, energize subcooling heat exchanger.
4. Casing: Galvanized steel sheet; with flame and heat resistant foamed polyethylene sound and thermal insulation.
5. Refrigerant Connections: Braze type.
6. Condensate Drainage: Provide unit that does not require condensate drainage.

2.05 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporator Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3-minute fused time delay, and test run switch.
   1. Refrigerant: Refrigerant circuits factory-charged with dehydrated air, for field charging.
   2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.
   3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffle louver fin and high heat exchange, rifled bore tube design; factory tested.
      a. Provide thermistor on liquid and gas lines.
   4. Fans: Direct-drive, with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.
   5. Return Air Filter: Washable long-life net filter with mildew proof resin, unless otherwise indicated.
   6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.
   7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

END OF SECTION 23 8129

SECTION 23 8200
CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Unit heaters.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. Product Data: Provide typical catalog of information including arrangements.

B. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
   3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

C. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

1.04 QUALITY ASSURANCE

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

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

B. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.

C. Acceptable Heating Element Assemblies:
   1. Vertical Projection Units:
      a. Finned tubular.
      b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.
      c. High-mass, all steel tubular type, copper brazed, centrally located and installed in fixed element banks.

D. Housing:
   1. Horizontal Projection Units:
      a. Provide with threaded holes for threaded rod suspension.
      b. Provisions for access to internal components for maintenance, adjustments, and repair.

E. Air Inlets and Outlets:
   1. Inlets: Provide stamped louvers or protective grilles with fan blade guard.
   2. Outlets: Provide diffuser cones, directional louvers, or radial diffusers.

F. Fan: Factory balanced, direct drive, axial type with fan guard.

G. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

H. Controls:
   1. Disconnect.
   2. Remotethermostat.

I. Electrical Characteristics:
   1. Disconnect Switch: Factory mount disconnect switch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
   2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Fan-Coil Units:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

SECTION 26 0000
SUPPLEMENTARY ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section includes supplementary general requirements for the following:
   1. Codes and Standards
   2. Conflicting Requirements
   3. Specifications and Drawing Conventions
   4. Fees, Permits, and Inspection
   5. Submittals
   6. Products
   7. Warranties
   8. Electrical License Requirement
   9. Operation and Maintenance Manuals
   10. Demolition, Salvage, and Waste
   11. General Coordination for Electrical Work
   12. Cutting and Patching
   13. Excavation and Trenching
   14. Painting
   15. Continuity Tests
   16. Connection Torque Tests
   17. Mechanical Operation Tests
   18. Rotational Tests

1.03 CODES, STANDARDS, AND REFERENCES

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. The **latest applicable edition** of specifications and standards of issues listed below but referred to thereafter by basic designation only, form a part of these specifications:
   1. National Electrical Code
   2. National Fire Protection Association’s Recommended Practices
   3. Local, City & State Codes & Ordinances
      National Electrical Safety Code
   4. Underwriter’s Laboratories, Inc.
   5. Illumination Engineering Society
   6. Institute of Electrical & Electronic Engineers
   7. Insulated Power Cable Engineers Association
   8. National Electrical Manufacturers Association
   9. Earthquake Requirement of the International Building Code
   10. American Society for Testing Materials
   11. Occupational Safety & Health Act
   12. Service requirements of serving utility company
   13. Americans with Disabilities Act (ADA)
   14. ASHRAE / IESNA Standard 90.1
   15. Arkansas Energy Code

1.04 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

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

B. 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 and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.06 FEES, PERMITS, AND INSPECTIONS

A. This Contractor shall be responsible for all costs incurred by any serving utility, municipal authority, and/or Owner for the relocation, removal, and installation of temporary or new services.

B. The Contractor shall be responsible for coordinating and providing the exact service equipment and installation methods with the serving utility, municipal authority, and/or Owner prior to bidding. Failure to do so will not constitute sufficient grounds for an authorized change order to the project.

1.07 PROJECT / SITE CONDITIONS:

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. The Architect / Owner reserves the right to relocate any device a maximum distance of 6’ - 0” at the time of installation without an extra cost being incurred.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect / Engineer before proceeding.

1.08 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. The Contractor shall submit five (5) copies to the Architect for approval, a list of all equipment he proposes to furnish, together with descriptive literature, capacities, manufacturer’s name, approximately delivery date and any other pertinent facts concerning the various items. The submittal shall consist of a tabulation of all items included, followed by catalog and data sheets, wiring diagrams, etc., all bound in one folder, loose leaf sheets will not be acceptable.
   2. The equipment listed herein or on the drawings will be furnished as specified unless scheduled “or equal”. If “or equal” is indicated, the product of any reputable manufacturer regularly engaged in the commercial production of the specified equipment will not be excluded on the basis of minor differences, provided all essential requirements of this

specification relative to materials, limitations of available space for equipment, capacity, and performance are met. The Contractor shall be responsible for any and all additional costs required by modifications to architectural, structural, mechanical or electrical facilities, devices, systems, etc. resulting from the approved substitution.

3. Wherever the substituted equipment actually furnished under these specifications requires the use of larger connections, more connections, or a different connection arrangement than indicated on the drawings or specified under these specifications, the Contractor shall furnish a scaled drawing showing how he proposes to install substituted equipment. Drawings shall show clearances and be coordinated with other mechanical and electrical equipment in the space. Should a substitution require the Architect or Engineer to provide additional services to accommodate it, the Contractor shall be responsible for costs incurred by the Architect or Engineer.
4. All equipment having motors 1-1/2 horsepower and larger shall include have as part of the submittal package, a written description of the motor, manufacturer, model number and motor efficiency at full load. Failure to include motor data in the equipment submittal shall result in the automatic rejection of the submittal.
5. The Contractor shall submit shop drawings to the Architect in accordance with the schedule prepared by the General Contractor but not later than 45 calendar days after the date of the agreement. Failure to submit shop drawings within 45 days, shall disqualify the Contractor from substituting specified equipment.
6. The contractor shall not install any equipment or materials until the shop drawings for the equipment or materials have been approved.
7. The Contractor shall submit five (5) copies to the Architect for approval, a list of all equipment he proposes to furnish, together with descriptive literature, capacities, manufacturer's name, approximately delivery date and any other pertinent facts concerning the various items. The submittal shall consist of a tabulation of all items included, followed by catalog and data sheets, wiring diagrams, etc., all bound in one folder, loose leaf sheets will not be acceptable.
8. The equipment listed herein or on the drawings will be furnished as specified unless scheduled "or equal". If "or equal" is indicated, the product of any reputable manufacturer regularly engaged in the commercial production of the specified equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, limitations of available space for equipment, capacity, and performance are met. The Contractor shall be responsible for any and all additional costs required by modifications to architectural, structural, mechanical or electrical facilities, devices, systems, etc. resulting from the approved substitution.
9. Wherever the substituted equipment actually furnished under these specifications requires the use of larger connections, more connections, or a different connection arrangement than indicated on the drawings or specified under these specifications, the Contractor shall furnish a scaled drawing showing how he proposes to install substituted equipment. Drawings shall show clearances and be coordinated with other mechanical and electrical equipment in the space. Should a substitution require the Architect or Engineer to provide additional services to accommodate it, the Contractor shall be responsible for costs incurred by the Architect or Engineer.
10. All equipment having motors 1-1/2 horsepower and larger shall include have as part of the submittal package, a written description of the motor, manufacturer, model number and motor efficiency at full load. Failure to include motor data in the equipment submittal shall result in the automatic rejection of the submittal.
11. The Contractor shall submit shop drawings to the Architect in accordance with the schedule prepared by the General Contractor but not later than 45 calendar days after the date of the agreement. Failure to submit shop drawings within 45 days, shall disqualify the Contractor from substituting specified equipment.
12. The contractor shall not install any equipment or materials until the shop drawings for the equipment or materials have been approved.
13. Engineer will return annotated file.

B. Digital Data Files:
   1. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
   2. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer's Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
   3. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings or Revit Model.

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

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 14 days for review of each resubmittal.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Name file with submittal number or other unique identifier, including revision identifier.
   2. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
      a. Project name.
      b. Name and address of Engineer.
      c. Name of Construction Manager.
      d. Name of Contractor.
      e. Name of firm or entity that prepared submittal.
      f. Names of subcontractor, manufacturer, and supplier.
      g. Category and type of submittal.
      h. Specification Section number and title.
      i. Indication of full or partial submittal.
      j. Remarks.

F. Options: Identify options requiring selection by Engineer.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
   1. Note date and content of revision in label or title block and clearly indicate extent of revision.
   2. Resubmit submittals until they are marked with approval notation from Engineer.

1.09 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:
   1. Operation and Maintenance Materials
   2. Record Drawings
   3. Demonstration and Training Materials

1.10 QUALITY ASSURANCE

A. Products:
   1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
      a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.

b. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

1.11 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

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 determine compliance with the Contract Documents and to determine 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 or moisture damage.
   4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   6. Protect stored products from damage and liquids from freezing.
   7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.12 PRODUCT WARRANTIES

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

B. Submit warranties in accordance with “Closeout Procedures.”

1.13 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.14 GUARANTEE/WARRANTY

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the electrical systems under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

1.15 ELECTRICAL LICENSE REQUIREMENT

A. No person shall perform electrical work on the contract without possessing a Master's or Journeyman's License from the State Electrical Examiners Board. All electrical work and apprentice electricians shall be supervised by a Master or Journeyman Electrician on a one to one ratio.

B. All electricians shall have a copy of their license with them and shall be required to show it to an appropriate inspector upon request.

PART 1 PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals to Engineer.
      a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. Mark each copy of each submittal to show which products and options are applicable.
   2. Include the following information, as applicable:
      a. Manufacturer's 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.
   3. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.
   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.

2.02 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.

2.03 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Where two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
   4. Where products are accompanied by the term "as selected," Engineer will make selection.
   5. Products containing asbestos shall not be used.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   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:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
   4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

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

2.04 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:
   1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   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. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections.

2.05 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. After approval of materials and equipment for use in this project, a copy of an Operation and Maintenance Manual shall be submitted for approval.

B. 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. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of equipment.
   3. Table of contents.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Upon final approval, submit one (1) bound copy of the approved Operation and Maintenance Manual to the Architect and hold two (2) copies for instruction of Owner as hereinafter specified.

2.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: 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.

2.07 EQUIPMENT AND MATERIALS:

A. All materials shall be new and shall bear the manufacturer’s name, trade name and the UL label in every case where a standard has been established for the particular material. The equipment to be furnished under each section of the specification shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer’s latest approved design.

B. When 2 or more units of materials or equipment of the same type or class are required, these units shall be products of 1 manufacturer. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance. Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

C. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

D. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment and materials shall be delivered to the site and stored in the original containers, suitably sheltered from the elements. Items subject to moisture damage (such as controls) shall be stored in dry, heated spaces.

F. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly. Damage or defects developing before acceptance of the work shall be made good at the Contractor’s expense.

G. It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. The Contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

H. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. Should the Contractor perform any work that does not comply with the manufacturer's directions, he shall bear all costs arising in correcting the deficiencies.

2.08 EQUIPMENT ACCESSORIES:

A. The Contractor shall furnish and install all equipment, accessories, connections, and incidental items necessary to fully complete the work, ready for use, occupancy and operation by the Owner, whether or not specifically shown on the plans or herein specified.

B. Connections: All final connections to equipment shall be installed as required by the manufacturer and/or Vendor.

C. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes. The Contractor shall provide any additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

PART 1 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL 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 Engineer.

B. 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.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it.

B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

D. Submittals not required by the Contract Documents may be returned by the Engineer without action.

3.03 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.
3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 RECORD DRAWING 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.

3.05 COORDINATION OF WORK

A. The Contractor shall compare the Electrical Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the Electrical Work. The Electrical Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the Electrical Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of conduits, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.
   1. Installation and Arrangement: The Contractor shall install all Electrical Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
   2. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in conduit, back box, device locations, etc. The Contractor shall provide any additional conduit, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All

changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All conduit connecting to equipment shall be installed without strain at the conduit connection

G. Inaccessible Equipment
   1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
   2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination
   1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
   2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
   3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Fan shafts, pump shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.06 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. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.
   2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
   3. 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. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements the “Occupant Coordination” article.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. 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.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   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 re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 EXCAVATION AND TRENCHING FOR ELECTRICAL CONDUIT

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other methods. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if the conduit or sleeves can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Trenches shall be of necessary width for proper laying of the conduit, and the banks shall be as nearly vertical as practical. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for the conduit on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of 4 inches below the trench depths indicated on the drawings, or specified. Overdepths in the rock excavation and unauthorized overdepths shall be backfilled with loose, granular, moist earth, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of

the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade coarse sand, fine gravel or other suitable materials, as hereinafter specified.

C. Depth of Cover: Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown. Exact depth of cover by Utility.

D. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense.

3.08 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until the utilities systems as installed confirm to the requirements of the drawings and specifications.

B. Normal Backfill: Where compacted backfill is not specified the trenches shall be carefully backfilled with the materials approved for backfilling (See appropriate section), deposited in 6" layers and thoroughly and carefully rammed until the pipe has a cover of not less than one foot. The remainder of the backfill material shall then be carefully placed in the trench in one foot layers and tamped. Settling the backfill with water will not be permitted. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition. Surface condition shall be equipment to match the existing condition prior to trenching (sod, asphalt, etc.).

C. Compacted backfill shall be used under slabs on grade, building structure, concrete paving and asphaltic concrete paving. The soils used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 1-1/2" maximum dimension.

3.09 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:
   1. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
   2. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound. Any equipment scratched, marred or damaged will be repainted to the original condition.

3.10 CONTINUITY TEST:

A. The Contractor shall perform a continuity test on the affected portion of the electrical system prior to energizing the system to insure proper cable connections.

3.11 CONNECTION TORQUE TESTS:

A. All larger conductor bolted connections shall be torque tested using a torque wrench. Torque shall be to National Electrical Testing Association's (NETA) Standards.

3.12 MECHANICAL OPERATION TESTS:

A. All electrical equipment, such as switches, circuit breakers, etc., shall be tested by operating the device to verify that the mechanical portions of the device are functioning.

3.13 ROTATIONAL TESTS:

A. The Contractor shall assist all other trades in performing rotational tests on all motors provided under this contract. If rotational tests determine that conductors must be transposed to change direction of rotation, the conductors shall be changed at the make-up box on the motor; or if the change is made elsewhere, then the conductor's color coding shall be changed.

SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.03 DESCRIPTION OF WORK

A. The extent of general building demolition work is shown on drawings. Coordinate the required electrical work with the general demolition.

B. Demolition includes complete wrecking of structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

C. Interior demolition includes complete wrecking of interior partitions, work above ceilings, finishes, and structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

D. The Owner shall have the option of retaining any items removed. The Contractor shall deliver these items to the Owner's designated storage area. Any items not retained by the Owner shall be disposed of off site by the Contractor.

E. Contractor shall be responsible for the protection of all existing spaces, materials, and equipment during all construction activities.

1.04 JOB CONDITIONS

A. Condition of Structures: The Owner assumes no responsibility for actual condition of structures to be demolished.

B. Conditions of the structure existing at time of inspection for bidding purposes will be maintained by owner in so far as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work. The drawings are schematic and provided as an aid in bidding. The contractor shall visit the site and determine the actual conditions prior to bidding.

C. Partial Removal: Items of salvable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.

D. Storage or sale of removed items on site will not be permitted.

E. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, occupied areas, and other adjacent occupied or used facilities.

F. Protections: Ensure safe passage of persons around or through area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

G. Install temporary electrical services, lighting, etc., as required by the Owner or authorities having jurisdiction.

H. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

PART 2 EXECUTION

2.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Report discrepancies to Architect before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

2.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

2.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

2.04 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove from site debris, rubbish, and other materials resulting from demolition operations. Pay all fees related to removal and dumping.
   1. Remove and dispose of interior demolition debris only.
   2. Burning of removed materials from demolished structures will not be permitted on site.

B. Removal:
   1. Transport materials removed from demolished structures and dispose of off site.

2.05 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION 26 0505

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Underground feeder and branch-circuit cable.
C. Service entrance cable.
D. Metal-clad cable.
E. Power and control tray cable.
F. Variable-frequency drive cable.
G. Wiring connectors.
H. Electrical tape.
I. Heat shrink tubing.
J. Oxide inhibiting compound.
K. Wire pulling lubricant.
L. Cable ties.
M. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2024).
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.
F. IEEE 1210 - IEEE Standard Tests for Determining Compatibility of Cable-Pulling Lubricants with Wire and Cable; 2004 (Corrigendum 2014).
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
I. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.
J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

S. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

B. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   1. Exceptions:
      a. Use power and control tray cable or metal-clad cable for installation in cable tray.

C. Nonmetallic-sheathed cable is not permitted.

D. Armored cable is not permitted.

E. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

J. Conductor Material:
   1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
   2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
   3. Tinned Copper Conductors: Comply with ASTM B33.

K. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.

L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

M. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 208Y/120 V, 3 Phase, 4 Wire System:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
         4) Neutral/Grounded: White.
      b. Equipment Ground, All Systems: Green.
      c. Travelers for 3-Way and 4-Way Switching: Pink.
      d. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
      e. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:
    a. Encore Wire Corporation
    b. General Cable Technologies Corporation
    c. Southwire Company
    d. Advance Wire and Cable, Inc

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
1. Feeders and Branch Circuits:
    a. Size 10 AWG and Smaller: Solid.
    b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    a. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 POWER AND CONTROL TRAY CABLE

A. Manufacturers:
1. Encore Wire Corporation
2. General Cable Technologies Corporation
3. Southwire Company

B. Description: NFPA 70, Type TC cable listed and labeled as complying with UL 1277.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type XHHW or XHHW-2.

F. Jacket: PVC or Chlorinated Polyethylene (CPE).

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:
1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors, mechanical connectors, or compression connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M
      b. Ideal Industries, Inc
      c. NSI Industries LLC

G. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC
      b. Ilsco
      c. Thomas & Betts Corporation

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC
      b. Ilsco
      c. Thomas & Betts Corporation

2.06 ACCESSORIES

A. Electrical Tape:
   1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
   2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
   3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant:
   1. Manufacturers:
      a. 3M:
      b. American Polywater Corporation
      c. Ideal Industries, Inc
   2. Listed and labeled as complying with UL 267.
   3. Suitable for use with conductors/cables and associated insulation/jackets to be installed, when tested in accordance with IEEE 1210; approved by conductor/cable manufacturer.
   4. Suitable for use at installation temperature.

E. Cable Ties: Material and tensile strength rating suitable for application.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
   1. Unless dimensioned, circuit routing indicated is diagrammatic.
   2. When circuit destination is indicated without specific routing, determine exact routing required.
   3. Arrange circuiting to minimize splices.
   4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
   5. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
   6. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
      a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
      b. Increase size of conductors as required to account for ampacity derating.
      c. Size raceways, boxes, etc. to accommodate conductors.
   7. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
   8. Provide oversized neutral/grounded conductors where indicated and as specified below.
      a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
      b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:
   1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
   2. Pull all conductors and cables together into raceway at same time.
   3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
   1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
   2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Terminate cables using suitable fittings.
   1. Metal-Clad Cable (Type MC):
      a. Use listed fittings.
      b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

H. Install conductors with a minimum of 12 inches of slack at each outlet.

I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

L. Make wiring connections using specified wiring connectors.
   1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
   2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
   3. Do not remove conductor strands to facilitate insertion into connector.
   4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
   5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

N. Insulate ends of spare conductors using vinyl insulating electrical tape.

O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials.

Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION 26 0519

SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Chemically-enhanced ground electrodes.

G. Ground plate electrodes.

H. Ground enhancement material.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

C. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Field quality control test reports.

D. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. ANSI/IEEE Compliance: Comply with C114.1 (IEEE Std 142) and IEEE Stds Nos. 241 and 242 pertaining to grounding and ground-fault protection of power systems.

D. ANSI/UL Compliance: Comply with requirements of ANSI/UL and UL standards pertaining to grounding and ground-fault protection equipment and devices. Provide products which have been UL-listed and labeled.

E. NEMA Compliance: Comply with NEMA Stds Pub Nos. PB 1.2 and AB 1, pertaining to construction and installation of ground-fault protection devices and molded-case circuit breakers.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

E. Grounding System Resistance:
   1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.
   2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
   3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

F. Grounding Electrode System:
   1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
      a. Provide continuous grounding electrode conductors without splice or joint.
      b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
   2. Metal Underground Water Pipe(s):
      a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.

b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

G. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

H. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
   a. Transformers (except autotransformers such as buck-boost transformers).
   b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
   c. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

I. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
   2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
   3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
   4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
   5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
   6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
   7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
   8. Provide bonding for metal building frame.

J. Communications Systems Grounding and Bonding:
   1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
   2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
      a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
      b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
      c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
      d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

K. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:
   1. Use insulated copper conductors unless otherwise indicated.
      a. Exceptions:
         1) Use bare copper conductors where installed underground in direct contact with earth.
         2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
   4. Manufacturers - Mechanical and Compression Connectors:
      a. Advanced Lightning Technology (ALT)
      b. Burndy LLC

c. Harger Lightning & Grounding
d. Thomas & Betts Corporation

5. Manufacturers - Exothermic Welded Connections:
   a. Burndy LLC
   b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

D. Ground Bars:
1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Harger Lightning & Grounding
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Galvan Industries, Inc
   c. Harger Lightning & Grounding

F. Chemically-Enhanced Ground Electrodes:
1. Description: Copper tube factory-filled with electrolytic salts designed to provide a low-impedance ground in locations with high soil resistivity; straight (for vertical installations) or L-shaped (for horizontal installations) as indicated or as required.
2. Length: 10 feet.
3. Integral Pigtail: Factory-attached, sized not less than grounding electrode conductor to be attached.
4. Backfill Material: Grounding enhancement material recommended by electrode manufacturer.
5. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Harger Lightning & Grounding

G. Ground Plate Electrodes:
1. Material: Copper.
2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
3. Manufacturers:
   a. Advanced Lightning Technology (ALT)
   b. Harger Lightning & Grounding
   c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

H. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Manufacturers:
   a. Harger Lightning & Grounding
   b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.

E. Make grounding and bonding connections using specified connectors.
   1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
   2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
   3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
   4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
   5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

F. Identify grounding and bonding system components in accordance with Section 26 0553.

G. Neutrals of lighting systems shall be grounded independently and in accordance with the National Electrical Code.

H. All metal raceway system, including cabinets, conduit and boxes, shall be grounded to a water pipe with UL approved grounding clamp in accordance with the National Electrical Code.

I. An equipment ground conductor shall be installed in all conduits.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.13.

C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 26 0526

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
    a. NFPA 70.
    b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
1. Manufacturers:
    a. HoldRite, a brand of Reliance Worldwide Corporation

D. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.
3. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2-inch diameter.
    b. Busway Supports: 1/2-inch diameter.
    c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
    d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
    e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
    f. Outlet Boxes: 1/4-inch diameter.
    g. Luminaires: 1/4-inch diameter.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.
10. Hammer-driven anchors and fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.
    d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:
1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners in accordance with manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 0529

SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. PVC-coated galvanized steel rigid metal conduit (RMC).
E. Flexible metal conduit (FMC).
F. Liquidtight flexible metal conduit (LFMC).
G. Galvanized steel electrical metallic tubing (EMT).
H. Stainless steel electrical metallic tubing (EMT).
I. Aluminum electrical metallic tubing (EMT).
J. Rigid polyvinyl chloride (PVC) conduit.
K. Liquidtight flexible nonmetallic conduit (LFNC).
L. Reinforced thermosetting resin conduit (RTRC).

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Cable assemblies consisting of conductors protected by integral metal armor.
B. Section 26 0526 - Grounding and Bonding for Electrical Systems.
    1. Includes additional requirements for fittings for grounding and bonding.
C. Section 26 0529 - Hangers and Supports for Electrical Systems.
D. Section 26 0533.16 - Boxes for Electrical Systems.
E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2025.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.
K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

M. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series; 2015.

N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

P. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

Q. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

R. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

S. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

T. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

U. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

V. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

W. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

Y. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

Z. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

AA. UL 2420 - Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or schedule 80 rigid PVC conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, stainless steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, stainless steel intermediate metal conduit (IMC) elbows, PVC-coated galvanized steel rigid metal conduit (RMC) elbows, or concrete-encased PVC elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
7. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
   1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
   2. Within Slab Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC). Embed within structural slabs only where approved by Structural Engineer.
   3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
   1. Locations subject to physical damage include, but are not limited to:
      a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
      b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal

conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

M. Corrosive Locations Above Ground: Use stainless steel rigid metal conduit (RMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), stainless steel electrical metallic tubing (EMT), or reinforced thermosetting resin conduit (RTRC).
   1. Corrosive locations include, but are not limited to:
      a. Cooling towers.

N. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).

O. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
   1. Maximum Length: 6 feet.

P. Flexible Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit (FMC).
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.

B. Electrical Service Conduits: See Section 26 2100 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 26 0526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4-inch trade size.
   3. Control Circuits: 1/2 inch (16 mm) trade size.
   4. Underground, Interior: 3/4-inch trade size.
   5. Underground, Exterior: 1-inch trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit
   2. Republic Conduit
   3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Electric Co
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit
   2. Republic Conduit
   3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Electric Co
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
   3. Material: Use aluminum.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit
   2. Republic Conduit
   3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Electric Co
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Robroy Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil, 0.040 inch.

D. PVC-Coated Boxes and Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Nonhazardous Locations: Use boxes and fittings listed and labeled as complying with UL 514A, UL 514B, or UL 6.
   3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   4. Material: Use steel or malleable iron.
   5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch.

2.07 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc
   2. Electri-Flex Company
   3. International Metal Hose

B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Electric Co
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc
   2. Electri-Flex Company
   3. International Metal Hose

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc
      b. O-Z/Gedney, a brand of Emerson Electric Co
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.09 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit

2. Republic Conduit
3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc
b. O-Z/Gedney, a brand of Emerson Electric Co
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
a. Do not use die cast zinc fittings.
4. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc
2. JM Eagle

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.11 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.12 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Manufacturers:
1. Champion Fiberglass, Inc
2. FRE Composites
3. United Fiberglass of America, Inc

B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

C. Supports: As recommended by manufacturer.

D. Fittings: Same type and manufacturer as conduit to be connected.
1. Cement-Tight Joints: Use bonded coupling or bell and spigot.
2. Cement-Tight and Watertight Joints: Use adhesive and manufacturer's standard gaskets.

2.13 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

F. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.

G. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

H. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
   1. Products:
      a. Menzies Metal Products; Electrical Roof Stack and Cap
      b. Menzies Metal Products; Electrical Retro Box

I. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
   1. Products:
      a. Quickflash Weatherproofing Products, Inc

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
   1. Products:
      a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Bore Spacers

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Aluminum Rigid Metal Conduit (RMC): Install in accordance with NECA 102.

E. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

F. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.

G. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

H. Liquidtight Flexible Nonmetallic Conduit (LFNC): Install in accordance with NECA 111.

I. Conduit Routing:
   1. Unless dimensioned, conduit routing indicated is diagrammatic.
   2. When conduit destination is indicated without specific routing, determine exact routing required.
   3. Conceal conduits unless specifically indicated to be exposed.
   4. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
      c. Within joists in areas with no ceiling.
   5. Unless otherwise approved, do not route exposed conduits:
      a. Across floors.
      b. Across roofs.
      c. Across top of parapet walls.
      d. Across building exterior surfaces.
   6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   9. Arrange conduit to provide no more than 150 feet between pull points.
   10. Route conduits above water and drain piping where possible.
   11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   14. Group parallel conduits in same area on common rack.

J. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 0529.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
   4. Use conduit strap to support single surface-mounted conduit.

a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
8. Install firestopping to preserve fire resistance rating of partitions and other elements.

M. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
a. Underground, Exterior: 18 inches.
b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 0553.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
   1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
   2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
   3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
   4. Where conduits are subject to earth movement by settlement or frost.

P. Conduit Sealing:
   1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
      a. Where conduits pass from outdoors into conditioned interior spaces.
      b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

Q. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

R. Provide grounding and bonding; see Section 26 0526.

S. Identify conduits; see Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 0533.13

SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Floor boxes.

F. Underground boxes/enclosures.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems:
   1. Conduit bodies and other fittings.
   2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   4. Access floor boxes.
   5. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
   1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
   2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended.
   4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
   5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
   1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
   2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
   3. Use suitable concrete type boxes where flush-mounted in concrete.
   4. Use suitable masonry type boxes where flush-mounted in masonry walls.
   5. Use raised covers suitable for the type of wall construction and device configuration where required.
   6. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   12. Minimum Box Size, Unless Otherwise Indicated:
      a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
      b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
      c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
   13. Wall Plates: Comply with Section 26 2726.
   14. Manufacturers:
      a. Hubbell Incorporated; Bell Products
      b. Hubbell Incorporated; RACO Products
      c. O-Z/Gedney, a brand of Emerson Electric Co
      d. Thomas & Betts Corporation

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
   1. Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
   2. NEMA EN 10250 Environment Type, Unless Otherwise Indicated:
      a. Indoor Clean, Dry Locations: Type 1, painted steel.
      b. Outdoor Locations: Type 3R, painted steel.
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
      b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
   4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
      a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
      b. Back Panels: Painted steel, removable.
      c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
   5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
   6. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation
      b. Hoffman, a brand of Pentair Technical Products

c. Hubbell Incorporated; Wiegmann Products

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
   1. Manufacturers:
      a. Hubbell Incorporated

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
   1. Manufacturers:
      a. Appleton, a brand of Emerson Electric Co
      b. Cooper Crouse-Hinds, a division of Eaton Corporation
      c. Hubbell Incorporated; Killark Products

F. Underground Boxes/Enclosures:
   1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
   2. Size: As indicated on drawings.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
   4. Provide logo on cover to indicate type of service.
   5. Applications:
      a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
      b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
      c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
   6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
      a. Manufacturers:
         1) Hubbell Incorporated; Quazite Products:
         2) MacLean Highline
         3) Oldcastle Precast, Inc
      b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
      c. Product(s):
         1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
         2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
         3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
   1. Manufacturers:
      a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:
   1. Locate boxes to be accessible. Provide access panels as required where approved by the Architect.
   2. Unless dimensioned, box locations indicated are approximate.
   3. Locate boxes as required for devices installed under other sections or by others.
      a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
   4. Locate boxes so that wall plates do not span different building finishes.
   5. Locate boxes so that wall plates do not cross masonry joints.
   6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
   7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
   8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
   9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
      a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
      b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
   10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
   11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
      a. Concealed above accessible suspended ceilings.
      b. Within joists in areas with no ceiling.
      c. Electrical rooms.
      d. Mechanical equipment rooms.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
   2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:
   1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
   2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
   3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

M. Install boxes as required to preserve insulation integrity.

N. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches deep.
   2. Flush-mount enclosures located in concrete or paved areas.
   3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
   4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

P. Install firestopping to preserve fire resistance rating of partitions and other elements.

Q. Close unused box openings.

R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

S. Provide grounding and bonding in accordance with Section 26 0526.

T. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 0533.16

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

B. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

C. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

D. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

C. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Switchboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      b. Panelboards:
         1) Identify ampere rating.
         2) Identify voltage and phase.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
         5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
         6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
      c. Transformers:
         1) Identify kVA rating.
         2) Identify voltage and phase for primary and secondary.
         3) Identify power source and circuit number. Include location when not within sight of equipment.
         4) Identify load(s) served. Include location when not within sight of equipment.
      d. Enclosed switches, circuit breakers, and motor controllers:
         1) Identify voltage and phase.
         2) Identify power source and circuit number. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location when not within sight of equipment.
   2. Service Equipment:
      a. Use identification nameplate to identify each service disconnecting means.
   3. Emergency System Equipment:
      a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
      b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
   4. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
   5. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
      a. Service equipment.
      b. Industrial control panels.
      c. Motor control centers.
      d. Elevator control panels.
      e. Industrial machinery.
   6. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter

socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
    a. Minimum Size: 3.5 by 5 inches.
    b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
    c. Service Equipment: Include the following information in accordance with NFPA 70.
        1) Nominal system voltage.
        2) Available fault current.
        3) Clearing time of service overcurrent protective device(s).
        4) Date label applied.

B. Identification for Conductors and Cables:
    1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
    2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
    3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
    4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    5. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:
    1. Use voltage markers, color-coded bands, or factory-painted conduits to identify systems other than normal power system for accessible conduits.
        a. Maximum Intervals: 20 feet.
        b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
            1) Field-Painting: Comply with Section 09 9123 and 09 9113.
            2) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
        c. Color Code:
    2. Use underground warning tape to identify underground raceways.

D. Identification for Devices:
    1. Identification for Communications Devices: Comply with Section 27 1000.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
    1. Manufacturers:
        a. Brimar Industries, Inc:
        b. Kolbi Pipe Marker Co
        c. Seton Identification Products
    2. Materials:
        a. Indoor Clean, Dry Locations: Use plastic nameplates.
        b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
    3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
    4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
    5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Manufacturers:
      a. Brady Corporation
      b. Brother International Corporation
      c. Panduit Corp
   2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend:
      a. System designation where applicable:
         1) Emergency Power System: Identify with text "EMERGENCY".
         2) Fire Alarm System: Identify with text "FIRE ALARM".
      b. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. System Designation: 1 inch.
      b. Equipment Designation: 1/2 inch.
   5. Color:
      a. Normal Power System: White text on black background.
      b. Emergency Power System: White text on red background.
      c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch.
   5. Color: Black text on white background unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
   1. Brady Corporation
   2. HellermannTyton
   3. Panduit Corp

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Minimum Size:
   1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

C. Legend:
   1. Markers for System Identification:
      a. Emergency Power System: Text "EMERGENCY".

D. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
   1. Brady Corporation
   2. Brimar Industries, Inc
   3. Seton Identification Products

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
   1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:

2.06 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc
   2. Clarion Safety Systems, LLC
   3. Seton Identification Products

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
   2. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:
   1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
   3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
   1. Surface-Mounted Equipment: Enclosure front.
   2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Conductors and Cables: Legible from the point of access.
9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 0553

SECTION 26 0583
WIRING CONNECTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0533.13 - Conduit for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

E. Section 26 2816.16 - Enclosed Switches.

F. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Comply with NEMA WD 1.
   2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
   3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 26 2726.

D. Flexible Conduit: As specified in Section 26 0533.13.

E. Wire and Cable: As specified in Section 26 0519.

F. Boxes: As specified in Section 26 0533.16.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings.

END OF SECTION 26 0583

SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. In-wall time switches.

D. Outdoor photo controls.

E. Lighting contactors.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 25 3626 - Integrated Automation Lighting Relays.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

G. Section 26 5100 - Interior Lighting.

H. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2023.

B. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2020.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

F. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

G. NEMA IA 10030 - Industrial Control and Systems: Enclosures; 2024.

H. NEMA IA 10039 - Control Circuit and Pilot Devices; 2025.

I. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

L. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

M. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

N. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

O. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

P. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

Q. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate placement of wall switch occupancy sensors with installed door swings.
   3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
   4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.
   5. Coordinate lighting control device product selections with luminaire characteristics; see Section 26 5100 and lighting fixture schedule.
   6. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

B. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

C. Field quality control reports.

D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. Provide five year manufacturer warranty for occupancy sensors.

B. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
   1. Hubbell Incorporated
   2. Lutron Electronics Company, Inc
   3. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

B. General Requirements:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
   3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
   4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during adjustable turn-off delay time interval.
   5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
   6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
   7. Sensitivity: Field adjustable.
   8. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above selected level.
   9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
   10. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.
      c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.

d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
e. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
f. Finish: Color to be selected by Architect..

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:
1. General Requirements:
a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.
b. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.
c. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.
d. Provide field adjustable dimming preset for occupied state.
e. Finish: Color to be selected by Architect.

E. Ceiling Mounted Occupancy Sensors:
1. General Requirements:
a. Description: Low profile occupancy sensors designed for ceiling installation.
b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
d. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
3. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within area of 450 square feet at mounting height of 9 feet, with field of view of 360 degrees.
b. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.
4. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
a. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet.

F. Directional Occupancy Sensors:
1. General Requirements:
a. Description: Occupancy sensors designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Directional Occupancy Sensors:
a. Standard Range Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.

b. Long Range Sensors: Capable of detecting motion within distance of 80 feet at mounting height of 10 feet.

3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.

G. Power Packs for Low-Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.
2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
3. Input Supply Voltage: Dual rated for 120/277 V ac.
4. Load Rating: As required to control load indicated on drawings.

H. Power Packs for Wireless Occupancy Sensors:
1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line-voltage loads.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Rating: As required to control load indicated on drawings.

2.03 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc
2. NSI Industries LLC
3. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

B. Digital Electronic Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
a. 24-Hour Time Switches: Single channel, with same schedule for each day of week and skip-a-day feature to omit selected days.
b. 7-Day Time Switches: Single channel, capable of different schedule for each day of week with additional holiday schedule available to override normal schedule for selected days.
c. Astronomic Time Switches: Single channel, capable of different schedule for each day of week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
3. Schedule Capacity: Not less than 16 programmable on/off operations.
4. Provide automatic daylight savings time and leap year compensation.
5. Provide power outage backup to retain programming and maintain clock.
6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
7. Provide remote photocell input with light level adjustment.
8. Input Supply Voltage: As indicated on the drawings.
9. Output Switch Configuration: As required to control load indicated on drawings.
10. Output Switch Contact Ratings: As required to control load indicated on drawings.
11. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:
a. Indoor clean, dry locations: Type 1.
b. Outdoor locations: Type 3R.
12. Provide flush-mounted unit where indicated, where mounted in public areas, or where mounted adjacent to flush-mounted equipment.

C. Electromechanical Time Switches:

1. Description: Factory-assembled controller with motor-operated timing dial mechanism and adjustable trippers for setting on/off operations, listed and labeled as complying with UL 917.
2. Program Capability:
    a. 24-Hour Time Switches: With same schedule for each day of week and skip-a-day feature to omit selected days.
    b. 7-Day Time Switches: Capable of different schedule for each day of week.
    c. Astronomic Time Switches: With same schedule for each day of week and skip-a-day feature to omit selected days with automatic adjustment for seasonal changes in sunrise and sunset times.
3. Schedule Capacity:
4. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
5. Input Supply Voltage: As indicated on the drawings.
6. Provide lockable enclosure; environmental type per NEMA EN 10250 as specified for the following installation locations:

2.04 IN-WALL TIME SWITCHES

A. Digital Electronic In-Wall Time Switches:
1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
2. Program Capability:
3. Schedule Capacity: Not less than 40 programmable on/off operations.
4. Provide power outage backup to retain programming and maintain clock.
5. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
6. Switch Configuration: Suitable for use in either SPST or 3-way application.
7. Contact Ratings: As required to control load indicated on drawings.

2.05 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
1. Intermatic, Inc
2. NSI Industries LLC

B. Stem-Mounted Outdoor Photo Controls:
1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control load indicated on drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control load indicated on drawings.

C. Locking Receptacle-Mounted Outdoor Photo Controls
1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control load indicated on drawings.

6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control load indicated on drawings.
8. Surge Protection: 160 joule metal oxide varistor.

D. Button Type Outdoor Photo Controls
1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control load indicated on drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control load indicated on drawings.

2.06 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB/GE
2. Eaton Corporation
3. Rockwell Automation Inc; Allen-Bradley Products;
4. Schneider Electric; Square D Products
5. Siemens Industry, Inc;

B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on drawings.

C. Short Circuit Current Rating:
1. Provide contactors with listed short circuit current rating not less than available fault current at installed location as indicated on the drawings.

D. Enclosures:
1. Comply with NEMA IA 10030.
2. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1 or Type 12.
b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.

2.07 ACCESSORIES

A. Auxiliary Contacts:
1. Comply with NEMA IA 10039.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control relays; see Section 25 3626

C. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 26 0533.16.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
      b. In-Wall Time Switches: 48 inches above finished floor.
      c. In-Wall Interval Timers: 48 inches above finished floor.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
   3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Maintain separation of remote-control, signaling, and power-limited circuits.
   1. See manufacturer instructions and Section 26 0519 for control wiring conductors, wiring methods, and identification requirements.

E. Install lighting control devices in accordance with manufacturer's instructions.

F. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Install lighting control devices plumb and level, and held securely in place.

H. Where required and not furnished with lighting control device, provide wall plate; see Section 26 2726.

I. Provide required supports; see Section 26 0529.

J. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

K. Occupancy Sensor Locations:
   1. Location Adjustments: Within design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Outdoor Photo Control Locations:
   1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.

2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.

M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.

N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.

O. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

P. Where indicated or required, provide cabinet or enclosure for mounting of lighting control device system components; see Section 26 0533.16.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of installed lighting control devices.
   4. Location: At project site.

END OF SECTION 26 0923

SECTION 26 2100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 2413 - Switchboards: Service entrance equipment.

G. Section 26 2416 - Panelboards: Service entrance equipment.

H. Section 26 2816.16 - Enclosed Switches: Service entrance equipment.

I. Section 26 4300 - Surge Protective Devices: Service entrance surge protective devices.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:
   1. Verify the following with Utility Company representative:
      a. Utility Company requirements, including division of responsibility.
      b. Exact location and details of utility point of connection.
      c. Utility easement requirements.
      d. Utility Company charges associated with providing service.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
   3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with other installers to provide communication lines required for Utility Company meters.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:
   1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
   2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

A. Comply with the following:
   1. IEEE C2 (National Electrical Safety Code).
   2. NFPA 70 (National Electrical Code).
   3. The requirements of the Utility Company.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility:
   1. Pad-Mounted Utility Transformers:
      a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
      b. Transformers: Furnished and installed by Utility Company.
      c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
      d. Primary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Utility Company.
      e. Secondary:
         1) Trenching and Backfilling: Provided by Contractor.
         2) Conduits: Furnished and installed by Contractor.
         3) Conductors: Furnished and installed by Contractor (Service Point at transformer).
   2. Pole-Mounted Utility Transformers:
      a. Utility Poles: Furnished and installed by Utility Company.
      b. Transformers: Furnished and installed by Utility Company.

c. Transformer Grounding Provisions: Furnished and installed by Utility Company.
d. Primary: Furnished and installed by Utility Company.
e. Secondary - Underground Service:
1) Conduits: Furnished and installed by Contractor.
2) Conductors: Furnished and installed by Contractor (Service Point at utility pole).
f. Secondary - Overhead Service:
1) Conduits/Service Masts: Furnished and installed by Contractor.
2) Conductors: Furnished and installed by Contractor (Service Point at service mast).
3. Terminations at Service Point: Provided by Utility Company.
4. Metering Provisions:
a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
d. Metering Transformers: Furnished and installed by Utility Company.
e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required protective bollards in accordance with Utility Company requirements.

E. Provide required support and attachment components in accordance with Section 26 0529.

F. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

G. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 26 2100

SECTION 26 2413
SWITCHBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

A. Section 25 3613 - Integrated Automation Power Meters: Smart (AMI and AMR) Meters.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2100 - Low-Voltage Electrical Service Entrance.

F. Section 26 2713 - Electricity Metering: For interface with equipment specified in this section.

G. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2016.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

F. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

J. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

K. UL 891 - Switchboards; Current Edition, Including All Revisions.

L. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Service Entrance Switchboards:
   1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
   2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
   3. Obtain Utility Company approval of switchboard prior to fabrication.
   4. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
   5. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

B. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Identify mounting conditions required for equipment seismic qualification.

C. Manufacturer's equipment seismic qualification certification.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Requirements of local autorities having jurisdiction.

C. Applicable local codes.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Switchboards:
   1. Schneider Electric; Square D Products
   2. Siemens Industry, Inc
   3. Eaton Corporation

2.02 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Service Entrance Switchboards:
   1. Listed and labeled as suitable for use as service equipment according to UL 869A.
   2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
   3. Comply with Utility Company requirements for electrical service.

E. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet.
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
   2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

F. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
   2. Minimum Rating: 65,000 rms symmetrical amperes.

G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

H. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Aluminum.
   5. Ground Bus Material: Aluminum.

I. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
b. Lug Type:
1) Provide mechanical lugs unless otherwise indicated.

J. Enclosures:
1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
b. Outdoor Locations: Type 3R.
2. Finish: Manufacturer's standard unless otherwise indicated.
3. Outdoor Enclosures:
a. Enclosure Type: Non-walk-in type unless otherwise indicated.
b. Color: Manufacturer's standard.
c. Access Doors: Lockable, with all locks keyed alike.
d. Walk-in Enclosure Features:
1) Personnel Doors: Open to exterior; equipped with panic hardware.
2) Aisle lighting, with switch at each access door.

K. Future Provisions:
1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 262413 and Section 264300, list switchboards as a complete assembly including surge protective device.
1. Surge Protection Device (SPD):
a. Factory installed, integrated within switchboar.
b. Listed as complying with UL1449.
c. Surge Current Rating: Not less than 240kA per phase.
d. Voltage: Match switchboard nominal system voltage.
e. Protected Modes:
1) Wye Systems: L-L, L-N, L-G, and N-G.
2) Delta Systems: L-L and L-G.
f. Protection Circuits: Modular, field replaceable.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

N. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

O. Owner Metering: Comply with Section 26 2713.

P. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   2. Molded Case Circuit Breakers:
      a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
         1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
      c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      d. Provide the following features and accessories where indicated or where required to complete installation:
         1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
   3. Insulated Case Circuit Breakers:
      a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
      b. Operation:
         1) Provide manually operated circuit breakers unless otherwise indicated.
      c. Construction:
         1) Provide fixed-mount circuit breakers unless otherwise indicated.
      d. Trip Units: Solid state, microprocessor-based, true rms sensing.
      e. Provide the following features and accessories where indicated or where required to complete installation:
         1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.04 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.
   3. Grounding of instrument transformer cases test.
   4. Electrical operation and control wiring tests, including polarity and sequence tests.
   5. Ground-fault sensing equipment test.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install switchboards plumb and level.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Install all field-installed devices, components, and accessories.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable circuit breaker tripping function settings as directed.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

L. Provide filler plates to cover unused spaces in switchboards.

3.03 FIELD QUALITY CONTROL

A. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

C. Inspect and test in accordance with NETA ATS, except Section 4 or manufacturer recommended startup.

D. Perform inspections and tests listed in NETA ATS, Section 7.1 or manufacturer recommended startup.

E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 or per manufacturer recommended startup for all main circuit breakers. Tests listed as optional are not required.

F. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14 or per manufacturer recommended startup. The insulation-resistance test on control wiring listed as optional is not required.

G. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10 or per manufacturer recommended startup. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

H. Test shunt trips to verify proper operation.

I. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 26 2413

SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e, with Amendments (2022).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

D. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

E. NEMA PB 1 - Panelboards; 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000V or Less; 2023.

G. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 67 - Panelboards; Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

O. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

P. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
   1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

C. Manufacturer's equipment seismic qualification certification.

D. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.

2. Ambient Temperature:
    a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:
    1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
    1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
    2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
    1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
        a. Indoor Clean, Dry Locations: Type 1.
        b. Outdoor Locations: Type 3R.
    2. Boxes: Galvanized steel unless otherwise indicated.
        a. Provide wiring gutters sized to accommodate the conductors to be installed.
        b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
        c. Provide removable end walls for NEMA Type 1 enclosures.
        d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
    3. Fronts:
        a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
        b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
        c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
    4. Lockable Doors: All locks keyed alike unless otherwise indicated.

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

M. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

N. Load centers are not acceptable.

O. Provide the following features and accessories where indicated or where required to complete installation:
    1. Feed-through lugs.

2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase and Neutral Bus Material: Copper.
   2. Ground Bus Material: Copper.

D. Circuit Breakers:
   1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:
   1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
   1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
   2. Phase and Neutral Bus Material: Copper.
   3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
   1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
   2. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

6. Provide the following circuit breaker types where indicated:
    a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
    b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
    c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
    d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
    e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 0526.

L. Install all field-installed branch devices, components, and accessories.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Fire detection and alarm circuits.

Q. Identify panelboards in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than _____ amperes. Tests listed as optional are not required.

C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

D. Test GFCI circuit breakers to verify proper operation.

E. Test AFCI circuit breakers to verify proper operation.

F. Test shunt trips to verify proper operation.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2416

SECTION 26 2726
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Fan speed controllers.

D. Receptacles.

E. Wall plates and covers.

F. Floor box service fittings.

G. Poke-through assemblies.

H. Access floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g (Validated 2023).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

N. UL 1917 - Solid-State Fan Speed Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Wall Dimmers: Include derating information for ganged multiple devices.

B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

C. Operation and Maintenance Data:
   1. Wall Dimmers: Include information on operation and setting of presets.
   2. GFCI Receptacles: Include information on status indicators.

D. Project Record Documents: Record actual installed locations of wiring devices.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   2. Extra Keys for Locking Switches: Two of each type.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.

C. Prewired Wiring Device and Outlet Box Assemblies: Factory-assembled products complying with requirements for wiring devices, boxes, and wiring methods may be used in lieu of field-assembled products.
   1. Wiring: See Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.
   2. Boxes: See Section 26 0533.16 - Boxes for Electrical Systems.

D. Wiring Device Applications:
   1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
   2. Receptacles Installed in Dwelling Units: Use tamper-resistant receptacles.
   3. Provide GFCI protection for:
      a. Receptacles installed within 6 feet of sinks.
      b. Receptacles installed in kitchens.
      c. Receptacles serving electric drinking fountains.

4. Single Receptacles Installed on Individual Branch Circuits: Provide receptacle ampere rating equal to branch circuit rating.
5. Flush Floor Service Fittings in Tile Floors: Use tile rings.
6. Flush Floor Service Fittings in Carpeted Floors: Use carpet flanges.

E. Wiring Device Finishes:
1. Provide wiring device finishes as selected by the Architect.

2.02 WALL SWITCHES

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Pass & Seymour, a brand of Legrand North America, Inc

B. General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Commercial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.03 WALL DIMMERS

A. Manufacturers:
1. Leviton Manufacturing Company, Inc
2. Lutron Electronics Company, Inc; Maestro Series
3. Pass & Seymour, a brand of Legrand North America, Inc

B. General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings.

2.04 FAN SPEED CONTROLLERS

A. Manufacturers:
1. Leviton Manufacturing Company, Inc
2. Lutron Electronics Company, Inc; Maestro Series
3. Pass & Seymour, a brand of Legrand North America, Inc

B. Description: 120 V AC, solid-state, full-range variable speed, slide control type with separate on/off switch, with integral radio frequency interference filtering, fan noise elimination circuitry, power failure preset memory, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1917.
1. Current Rating: 1.5 A unless otherwise indicated or required to control the load indicated on the drawings.

2.05 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Pass & Seymour, a brand of Legrand North America, Inc

B. General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
3. Tamper Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
4. Tamper Resistant and Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
1. General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
a. Provide test and reset buttons of same color as device.
2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
4. Tamper Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:
1. General Requirements: Listed as complying with UL 1310.
a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

F. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.06 WALL PLATES AND COVERS

A. Manufacturers:
1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc

3. Lutron Electronics Company, Inc
4. Pass & Seymour, a brand of Legrand North America, Inc

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Weatherproof Receptacle Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

F. Weatherproof Receptacle Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.07 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated
2. Thomas & Betts Corporation
3. Wiremold, a brand of Legrand North America, Inc

B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.

2.08 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
1. Hubbell Incorporated
2. Thomas & Betts Corporation
3. Wiremold, a brand of Legrand North America, Inc

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Wall Dimmers: 48 inches above finished floor.
      c. Fan Speed Controllers: 48 inches above finished floor.
      d. Receptacles: 18 inches above finished floor or 6 inches above counter.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
   4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
   5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

C. Test each receptacle to verify operation and proper polarity.

D. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

E. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726

SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA BS 31047 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013 (Reaffirmed 2023).

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

D. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
   1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
   2. Minimum Ratings:
      a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
      b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. Enclosures: Comply with NEMA EN 10250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
      b. Outdoor Locations: Type 3R.

2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
      a. Provide means for locking handle in the ON position where indicated.

P. Provide the following features and accessories where indicated or where required to complete installation:
   1. Hubs: As required for environment type; sized to accept conduits to be installed.
   2. Integral fuse pullers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2816.16

SECTION 26 5100
INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0923 - Lighting Control Devices.
   1. Includes automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
   2. Includes lighting contactors.

D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

E. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

F. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

K. UL 1598 - Luminaires; Current Edition, Including All Revisions.

L. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits; Current Edition, Including All Revisions.

M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc.

required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 3-year manufacturer warranty for LED luminaires, including drivers.

C. Provide 5-year pro-rata warranty for batteries for emergency lighting units.

D. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
   3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
   1. LED Tape - General Requirements:
      a. Listed.
      b. Designed for field cutting in accordance with listing.
      c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

J. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:
   1. Sealed maintenance-free lead calcium unless otherwise indicated.
   2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single- or double-face as indicated or as required for installed location.
   2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
   2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:
   1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
   2. Control Compatibility: Fully compatible with the dimming controls to be installed.
      a. Wall Dimmers: See Section 26 2726.

2.06 LAMPS

A. Lamps - General Requirements:
   1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
   2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
   3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
   4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
   5. Unless otherwise noted, color temperature shall be 3500k for indoor fixtures and 4000k for exterior fixtures.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   4. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.
   5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:
   1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   2. Install canopies tight to mounting surface.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire.

O. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5100

SECTION 26 5600
EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Ballasts.

C. Poles and accessories.

D. Luminaire accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

C. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

D. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2025.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 844 - Luminaires for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
   2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

3. Provide structural calculations for each pole proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
   2. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

E. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide 2-year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. Recessed Luminaires:
   1. Ceiling Compatibility: Comply with NEMA LE 4.
   2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

I. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

K. LED Luminaires:
1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.03 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

2.04 POLES

A. All Poles:
1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
a. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
3. Material: Steel, unless otherwise indicated. Fiberglass and Resin poles will not be accepted.
4. Shape: Square straight, unless otherwise indicated.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
a. Top cap.
b. Anchor bolts with leveling nuts or leveling shims.
c. Anchor base cover.
d. Provision for pole-mounted weatherproof GFI receptacle where indicated.

2.05 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Install foundations plumb.
      b. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      c. Tighten anchor bolt nuts to manufacturer's recommended torque.
   3. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5600

SECTION 27 0529
HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2024.

E. BICSI ITSIMM - Information Technology Systems Installation Methods Manual (ITSIMM), 8th Edition; 2022.

F. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

G. MFMA-4 - Metal Framing Standards Publication; 2004.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

L. UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
   2. Coordinate work to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
   4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
   5. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
   1. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1.06 QUALITY ASSURANCE

A. Maintain at project site one copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with the following. Where requirements differ, comply with most stringent.
      a. TIA-569.
      b. NFPA 70.
      c. Applicable building code.
      d. Requirements of authorities having jurisdiction.
   2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
   3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
      c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
      d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit Supports: Straps and clamps suitable for conduit to be supported.
   1. Manufacturers:
   2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   3. Conduit Clamps: Bolted type unless otherwise indicated.

C. Noncontinuous Cable Supports: Suitable for cables to be supported, including but not limited to J-hooks, bridle rings, drive rings, and flexible harnesses/slings.
   1. Applications:
      a. Do not exceed 5 feet between cable supports.
      b. Maximum Number of Cables per Cable Support:
         1) J-Hooks: 40 percent of fill capacity.
      c. Allowable Cable Types:

1) J-Hooks: Category 3, Category 5e, and Category 6.

2. Cable Supports Installed in Spaces Used for Environmental Air: Plenum rated; listed and labeled as complying with UL 2043, suitable for use in air-handling spaces.
3. J-Hooks: Noncontinuous cabling support with removable top retainer clip.
   a. Material: Use galvanized steel, factory-painted steel, or stainless steel.
   b. Provide support surfaces with smooth, beveled edges and radius not less than minimum allowable bend radius of cables supported.
   c. Provide multitiered J-hooks where required to support multiple cabling systems.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

E. Metal Channel/Strut Framing Systems:
1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.

F. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2-inch diameter.
   b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
   c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
   d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
   e. Outlet Boxes: 1/4-inch diameter.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are not permitted.
11. Hammer-driven anchors and fasteners are not permitted.
12. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
    b. Comply with MFMA-4.
    c. Channel Material: Use galvanized steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Provide required seismic controls.

I. Equipment Support and Attachment:
   1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
   2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
   3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
   4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

K. Secure fasteners in accordance with manufacturer's recommended torque settings.

L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 27 0529

SECTION 27 1000
STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Fiber optic cable and interconnecting devices.

E. Communications equipment room fittings.

F. Communications outlets.

G. Communications grounding and bonding.

H. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products.

1.03 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.

B. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.

C. ICEA S-83-596 - Indoor Optical Fiber Cable; 2021.

D. ICEA S-90-661 - Category 3 and 5E Individually Unshielded Twisted Pairs, Indoor Cables (With or Without an Overall Shield) for Use in General Purpose and LAN Communication Wiring Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).

G. TIA-492AAAC - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; 2009b.

H. TIA-526-7 - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 Edition 2: Fibre-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement; 2015a (Reaffirmed 2022).

I. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; IEC 61280-4.1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement; 2023d.

J. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2024.

K. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2018d, with Addenda (2020).

L. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.

M. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

N. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

O. TIA-607 - Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2024e.

P. UL 444 - Communications Cables; Current Edition, Including All Revisions.

Q. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

R. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

S. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
   2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Evidence of qualifications for installer.

E. Field Test Reports.

F. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
   1. Record actual locations of outlet boxes and distribution frames.
   2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
   3. Identify distribution frames and equipment rooms by room number on drawings.

G. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 5 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
   1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
   2. Supervisors and installers factory certified by manufacturers of products to be installed.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
   2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
   4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
   1. Locate main distribution frame as indicated on the drawings.

C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 COPPER CABLE AND TERMINATIONS

A. Manufacturers:
   1. CommScope
   2. General Cable Technologies Corporation
   3. Siemon Company

B. Copper Backbone Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
   2. Cable Type: TIA-568.2 Category 3 UTP (unshielded twisted pair); 24 AWG.
   3. Cable Capacity: Quantity of pairs as indicated on drawings.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
      b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

C. Copper Horizontal Cable:
   1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
   2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
   3. Cable Capacity: 4-pair.
   4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
   5. Cable Jacket Color - Voice and Data Cable: Blue.
   6. Product(s):
      a. CommScope; SYSTIMAX Twisted Pair Cables; GigaSPEED XL Category 6 U/UTP Cable
      b. CommScope; Uniprise Twisted Pair Cables; CS34 Series Category 6 U/UTP Cable
      c. General Cable Technologies Corporation; GenSPEED Cables:

D. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

E. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 500 mating cycles.
   2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
   3. Product(s):
      a. CommScope; SYSTIMAX RJ45 Jacks; MGS400 Series Category 6 U/UTP Modular Jacks
      b. CommScope; Uniprise RJ45 Jacks; UNJ600 Series Category 6 U/UTP Modular Jacks

F. Copper Patch Cords:
   1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
   2. Patch Cords for Patch Panels:
      a. Quantity: One for each pair of patch panel ports.
      b. Length: _____ feet.
   3. Product(s):
      a. CommScope; SYSTIMAX Category 6 U/UTP Patch Cords
      b. CommScope; Uniprise Category 6 U/UTP Patch Cords

2.03 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. Manufacturers:
   1. CommScope
   2. General Cable Technologies Corporation
   3. Siemon Company

B. Fiber Optic Horizontal Cable:
   1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
   2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC.
   3. Cable Capacity: 2-fiber.
   4. Cable Applications: Use listed NFPA 70 Type OFNP plenum cable unless otherwise indicated.
   5. Cable Jacket Color:
      a. Laser-Optimized Multimode Fiber (OM3/OM4): Aqua.
      b. Multimode Fiber (OM1/OM2): Orange.
      c. Single-Mode Fiber (OS1/OS2): Yellow.
   6. Product(s):
      a. CommScope Fiber Optic Cables; TeraSpeed Zero Water Peak Single-Mode Fiber

C. Fiber Optic Interconnecting Devices:
   1. Connector Type: Type LC.
   2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
   3. Maximum Attenuation/Insertion Loss: 0.3 dB.
   4. Product(s):
      a. CommScope Fiber Optic Connectors; QWIK II-LC Fiber Connectors

D. Fiber Optic Patch Cords:
   1. Description: Factory-fabricated 2-fiber cable assemblies with suitable connectors at each end.
   2. Patch Cords for Patch Panels:
      a. Quantity: One for each pair of patch panel ports.
      b. Length: _____ feet.
   3. Product(s):

a. CommScope Fiber Optic Patch Cords; TeraSpeed Fiber Patch Cords

2.04 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:
   1. Manufacturers:
      a. CommScope
      b. Siemon Company
   2. Connector Blocks for Category 3 Cabling: Type 66 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
   3. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
   4. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
      a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
      b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
      c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
      d. Provide incoming cable strain relief and routing guides on back of panel.
   5. Product(s):
      a. CommScope; SYSTIMAX Copper Panels; 360-IPR-1100-XX Series Patch Panels
      b. CommScope; Uniprise Copper Panels; UNP-XX-DM Series Patch Panels

B. Fiber Optic Cross-Connection Equipment:
   1. Manufacturers:
      a. CommScope
      b. Siemon Company
   2. Patch Panels for Fiber Optic Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum.
      a. Adapters: As specified above under FIBER OPTIC CABLE AND INTERCONNECTING DEVICES; maximum of 24 duplex adaptors per standard panel width.
      b. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
      c. Provide incoming cable strain relief and routing guides on back of panel.
      d. Provide rear cable management tray at least 8 inches deep with removable cover.
      e. Provide dust covers for unused adapters.
   3. Product(s):
      a. CommScope; SYSTIMAX Fiber Panels; HD Series Patch Panels: www.commscope.com/#sle.
      b. CommScope; Uniprise Fiber Panels; SD Series Patch Panels: www.commscope.com/#sle.

C. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
   1. Do not paint over UL label.

D. Equipment Frames, Racks and Cabinets:
   1. Manufacturers:
      a. CommScope
      b. Siemon Company
   2. Component Racks: EIA/ECA-310 standard 19 inch wide.
   3. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

E. Cable Management:

1. Manufacturers:
    a. CommScope
    b. Siemon Company
2. Product(s):
    a. CommScope Cable Runway
    b. CommScope Horizontal/Vertical Cable Managers; HCM-SS-XX-XX/VCM-DS-XX-XX Series
    c. CommScope FiberGuide Raceway

2.05 COMMUNICATIONS OUTLETS

A. Manufacturers:
    1. CommScope
    2. Siemon Company

B. Outlet Boxes: Comply with Section 26 0533.16.
    1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
    2. Minimum Size, Unless Otherwise Indicated:
        a. Voice Only Outlets: 4 inch by 2 inch by 2-1/8 inch deep (100 by 50 by 54 mm) trade size.
        b. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
        c. Fiber Optic Outlets: 4-11/16 inch square by 2-1/8 inch deep (119 by 54 mm) trade size.

C. Wall Plates:
    1. Comply with system design standards and UL 514C.
    2. Accepts modular jacks/inserts.
    3. Capacity:
        a. As indicated on drawings.

2.06 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

2.07 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

2.08 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test cables according to TIA-568 (SET).

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:
    1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
    2. 12 inches from power conduits and cables and panelboards.
    3. 5 inches from fluorescent and high frequency lighting fixtures.
    4. 6 inches from flues, hot water pipes, and steam pipes.

B. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.
      a. Mounting Heights: Unless otherwise indicated, as follows:
         1) Telephone and Data Outlets: 18 inches above finished floor.
         2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 54 inches above finished floor to top of telephone.
         3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
      b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
      c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
      d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
      e. Locate outlet boxes so that wall plate does not span different building finishes.
      f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
   1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
   2. Do not over-cinch or crush cables.
   3. Do not exceed manufacturer's recommended cable pull tension.
   4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
   1. At Distribution Frames: 120 inches.
   2. At Outlets - Copper: 12 inches.
   3. At Outlets - Optical Fiber: 39 inches.

C. Copper Cabling:
   1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
   2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
   3. Use T568B wiring configuration.

D. Fiber Optic Cabling:
   1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
   2. Support vertical cable at intervals as recommended by manufacturer.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Identification:
   1. Use wire and cable markers to identify cables at each end.
   2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
   3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:
   1. Inspect cable jackets for certification markings.
   2. Inspect cable terminations for color coded labels of proper type.
   3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:
   1. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 3 Backbone: Perform attenuation test.
   5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.
   6. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
   7. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Testing - Fiber Optic Cabling:
   1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
   2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
   3. Single Mode Backbone: Perform tests in accordance with TIA-526-7.

F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 1000

SECTION 28 4600
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system and associated components, including control units, related equipment, initiating devices, and notification appliances.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware:

B. Section 14 2100 - Electric Traction Elevators: For interface with fire alarm system.

C. Section 14 2400 - Hydraulic Elevators: For interface with fire alarm system.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: For interface with fire alarm system.

E. Section 21 3000 - Fire Pumps: For interface with fire alarm system.

F. Section 23 3300 - Air Duct Accessories: Smoke/fire dampers for interface with fire alarm system.

G. Section 26 0533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Evidence of designer qualifications.

C. Comply with NFPA 72 chapter "Documentation," including noting names of installers, owners, and system classification information.

D. Design Documents: Submit all information required for plan review and permitting by AHJ, including floor plans, riser diagrams, and description of operation.
   1. Copy (if any) of list of data required by AHJ.
   2. NFPA 72 "Record of Completion", filled out to extent known at time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A, and complete listing of software required.
   4. Manufacturer's detailed product data sheet for each component, including wiring diagrams, and circuit length limitations. Catalog pages and product descriptions include ratings, dimensions, finishes, service conditions, and included features.
   5. Certification by manufacturer of FACU that system design complies with Contract Documents.

6. Certification by Contractor that system design complies with Contract Documents.

E. Shop Drawings: Submit installation documentation required for plan review and permitting by AHJ, including floor plans showing locations of fire alarm system components, enlarged drawn to identified scale plan view, and riser diagrams.
   1. System zone boundaries and interfaces to fire safety systems.
   2. Show locations of components, circuits, and raceways; mark components with identifiers used in control unit programming.
   3. Include elevations and details of proposed equipment arrangements.
   4. Include system interconnection schematic riser diagram showing proposed and approved cable size and type; coordinated with floor plans and describing circuit class, survivability, and application specific information required by NFPA 72.
   5. Include typical wiring diagrams for devices, notification appliances, remote indicators, annunciators, remote test stations, and EoL and power supervisory devices.
   6. Include requirements and control diagrams for interfacing with other systems.
   7. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; standby and spare capacity calculations; notification appliance circuit loop resistance and voltage drop calculations, including spare capacity.
   8. List of devices and notification appliances on each SLC, with spare capacity indicated.
   9. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   10. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   11. Detailed drawing of graphic annunciators, displays, and interfaces.
   12. Certification by either FACU manufacturer or manufacturer of related equipment.
   13. Certification by FACU manufacturer that system design complies with Contract Documents.
   14. Certification by Contractor that system design complies with Contract Documents.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Evidence of installer qualifications.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test," filled out.

J. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by AHJ.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures require recording of system trouble events by qualified personnel, such as when routine testing is being conducted for fire drills and when entering into contracts for building renovations.

K. Project Record Documents: See Section 01 7800 for additional requirements, have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, and updated input/output chart.

L. Closeout Documents:
   1. Certification by manufacturer that system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion," filled out completely and signed by installer and authorized representative of AHJ.
   3. Certificate of Occupancy.
   4. Maintenance contract.

M. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
   1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data and place in spare parts cabinet.
   2. In addition to items in quantities indicated in PART 2, furnish the following:
      a. Tools, software, and documentation necessary to modify fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, notification appliances, circuits, and zones, and changes to system description, and operation.
      b. One copy of software not resident in read-only-memory.
      c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III (three) or Level IV (four) certified fire alarm technician or registered fire protection engineer, employed by FACU manufacturer, Contractor, or installer, with experience designing fire alarm systems in jurisdictional area of AHJ.

B. Installer Qualifications: Firm with minimum three years documented experience installing fire alarm systems of specified type and providing contract maintenance service as regular part of their business.
   1. Authorized representative of FACU manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least two years of experience installing fire alarm systems.
   3. Supervisor: Level III (three) or Level IV (four) certified fire alarm technician; furnish name and address.
   4. Contract maintenance office located within 50 miles of project site.
   5. Certified in the State in which the Project is located as fire alarm installer.

C. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section with at least three years of documented experience.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

1.06 WARRANTY

PART 2 PRODUCTS

2.01 FIRE ALARM SYSTEM

A. General Requirements:

1. Provide new fire alarm system complying with NFPA 70, NFPA 72, NFPA 90A, and consisting of required equipment, conduit, cabinets, outlet boxes, wiring, connectors, hardware, supports, accessories, components, software, and system programming as necessary for complete operating system that provides functional intent indicated.
2. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    a. 36 CFR 1191 and ADA Standards.
    b. Requirements of AHJ.
    c. Applicable local codes.
    d. Contract Documents.
    e. NFPA 72; "should" is mandatory; where conflicts between requirements require deviation, identify deviations clearly on design documents.
3. Fire Alarm System Products:
    a. Listed, classified, and labeled as suitable for purpose intended.
    b. Installation Environments: Provide products suitable for their respective indoor and outdoor applications.
4. Provide fire alarm circuits in accordance with NFPA 70.
    a. Comply with methods of interconnecting FACUs in accordance with NFPA 72 and NFPA 70.
    b. Power Sources:
        1) Comply with requirements for power supplies of emergency systems in accordance with NFPA 70.
        2) Primary: Dedicated branch circuits from facility power distribution system.
        3) Secondary: Storage batteries with capacity to operate system for period specified by NFPA 72.
    c. Wiring and Wiring Methods:
        1) General Requirements:
            (a) Comply with requirements for wiring and wiring methods in accordance with NFPA 70.
            (b) Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum-rated, listed and labeled as suitable for use in return air plenums.
            (c) Special Occupancies: Comply with NFPA 70.
            (d) Comply with NFPA 70 for wire and cable plenum, riser, general-purpose, limited-use, undercarpet, and underground applications.
        2) Fire Alarm Circuits:
            (a) Comply with NFPA 70 for conditions and types required for multiconductor cable systems.
            (b) Non-Power-Limited Fire Alarm (NPLFA) Circuits:
                (1) Provide dedicated NPLFA non-GFCI branch circuits for fire alarm equipment and marked by red identification in accordance with NFPA 70.
            (c) Power-Limited Fire Alarm (PLFA) Circuits:
                (1) Provide identification for PLFA circuits in accordance with NFPA 70.
5. Provide pathway class designations and pathway survivability, as defined in NFPA 72.
    a. Provide monitoring of conductors and other signaling channels for integrity and circuit performance.
    b. Pathway Class Designations:
        1) Unless otherwise indicated or required, pathways to meet the following requirements:
            (a) SLCs: Class B (star, tee-tap, multi-tap, with no return).
            (b) IDCs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

(c) NACs: Class B (daisy-chain with EoL resistor device installed at end of circuit).

B. Fire Alarm System Interfaces and Control Functions:
   1. UL 864 listed unless otherwise indicated.
   2. Descriptions below are intended to provide means for interface. See project SOOs, narrative, and input/output matrix for execution requirements.
   3. Provide initiating devices, interfaces, and control functions for emergency control function interfaces in accordance with NFPA 72.
   4. Provide monitoring of interconnected systems. Coordinate notification appliance alternate markings as indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:

B. Field Locations:
   1. Obtain Owner's approval of locations of devices and notification appliances before installation.
   2. Arrange equipment to provide minimum operational clearances and required maintenance access in accordance with manufacturer's instructions and NFPA 70.
   3. Conceal wiring, conduit, outlet boxes, and supports where installed in finished areas; maintain code-required access.

C. Raceways and Supports:
   1. Coordinate locations of outlet boxes as required for installation. Only install boxes and equipment at locations based on application standards indicated in NFPA 72.
   2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
   3. Install firestopping to preserve fire resistance rating of partitions and other elements.

D. Wiring and Connections:
   1. Maintain separation of Class 1, Class 2, Class 3 remote-control, signaling, fire alarm circuits, and power-limited circuits in accordance with cable insulation class and NFPA 70.
   2. Maintain circuit pathway and class designations in accordance with NFPA 72 for configuration, separation, and survivability.
   3. Comply with permitted and not permitted installations for wires, cables, cable routing assemblies, communications circuits, and fire alarm circuits in accordance with NFPA 70.
   4. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by AHJ. Provide independent support from building structure and suspended ceiling systems. Do not provide support from raceways, piping, ductwork, or other systems.
   5. Provide grounding and bonding in accordance with Section 26 0526.
   6. Comply with manufacturer's minimum cable sizes or ratings.
   7. Do not exceed manufacturer's recommended maximum power, signal, or network cable lengths between components.
   8. Provide network wiring in accordance with NFPA 70.
   9. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
   10. See manufacturer's instructions for batteries.

E. Fire Alarm System Components:
   1. Install field-installed devices, components, relays, notification appliances, accessories, and when applicable EoL resistors.
      a. Install wiring to supervisory devices and associated EoL resistors as required for supervision of hardwired connections

2. Install Wall-Mounted Equipment: Assemble component hardware within (e.g., card bays, sub-bays, expansion bays, signal cards, other card frames, networking, signal transmission, application modules, tamper monitoring devices, interconnecting modules, and auxiliary power supplies), including space for required spare capacity, and configure settings.
3. Install Interconnect Wiring: Connect system cabinets, install processor and cards, cabling, connectors, terminations, and bonding.

F. Branch Power:
1. After installation confirmations, follow manufacturer instructions to connect branch circuit power cables to premises fire alarm system components; comply with NFPA 70.
2. Where accessories require auxiliary power, provide control power source and monitoring as indicated or as required to complete installation.
3. Install auxiliary power supplies, including indicated monitoring, and connections necessary for remote equipment.

G. System Identification:
1. Identify devices, notification appliances, components, cables, and equipment in accordance with approved submittals. See Section 26 0553.
2. Confirm fire alarm system programming meets requirements of SOO and sub-system SOOs.
3. Mark location of disconnecting means for NPFLA circuits.
4. Coordinate to provide red branch power circuit protective devices or identify them accordingly as required by NFPA 72 and NFPA 70.
5. Mark date of batteries installed on inside cover of panels and formal maintenance logs.

H. Troubleshooting and Installer Checks:
1. Field test connectivity periodically during installation process to avoid unexpected troubleshooting.
2. Check system operation for notification, FACU functions, circuit supervision, alarm initiating devices, supervisory initiating devices, dress panels/doors/covers, and programming before performing field tests.

I. Fire Alarm System Tests:
1. Perform required tests of NFPA 72. Record measured values during operational checks.
2. Confirm functional testing of fire alarm system is as indicated in Contract Documents.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify AHJ and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide services of installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that work is complete and correct; perform preliminary tests as required.

E. Provide tools, software, and supplies required to accomplish inspection, testing, and document results.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of AHJ; document each inspection and test.

G. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without system or equipment malfunctions.
1. Record system operations and malfunctions.
2. If malfunction occurs, start diagnostic period over after correction of malfunction.

3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.

B. Administrative: One-hour session(s) covering issues necessary for nontechnical administrative staff; classroom:
   1. Initial Training: One session precloseout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: One session precloseout.

D. Use operation and maintenance documentation as primary instruction material; have paper copies available for attendees and supplement training material aids.

3.04 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals for additional submittals.

B. See Section 01 7900 - Demonstration and Training for additional requirements.

C. Closeout Demonstration: Demonstrate operation of all functions to Owner.
   1. Be prepared to conduct any of required tests.
   2. Have minimum one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of FACU manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by AHJ; notify AHJ with enough time to schedule demonstration.
   5. Repeat demonstration until successful.

D. Occupancy will not occur prior to Substantial Completion.

E. Substantial Completion of project cannot be achieved until inspection and testing is successful and the following:
   1. Specified diagnostic period without malfunction has been completed.
   2. Approved operating and maintenance data has been delivered.
   3. Spare parts, extra materials, and tools have been delivered.
   4. All aspects of operation have been demonstrated to Owner.
   5. Final acceptance of fire alarm system has been given by AHJ.
   6. Occupancy permit has been granted.
   7. Specified precloseout instruction is complete.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, written maintenance contract for entire manufacturer's warranty period, to include work described below.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond control of maintenance contractor.

3. Record keeping required by NFPA 72 and AHJ.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within two hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with detailed schedule.

F. Maintain on-site log listing date and time of each inspection and call-back visit, condition of system, nature of trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 4600

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removing existing vegetation.
2. Clearing and grubbing.
3. Temporary erosion and sedimentation control.

1.2 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

C. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.6 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished

materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 0040

MICROPILES

PART 1 - GENERAL

1.01 GENERAL INFORMATION

A. The Contractor shall select the micropile type, size, and determine the required grout bond length and final micropile diameter. The Contractor shall design and install micropiles that will develop the allowable loads indicated on the drawings. The micropile design compressive and tension load capacity shall be verified by testing as required and shall meet the test acceptance criteria specified herein. The Owners Engineer will be responsible for micropile cap design. The Contractor's micropile design, including the load test program, proposed micropile layout, corrosion protection details, connection to footings, and the work plan should be reviewed by the design team and approved by the Engineer prior to acceptance and the start of work.

B. The Contractor shall allow for all necessary operations including cutting through concrete slabs, pavements, or other obstructions, scaffolding, platforms, handling equipment, tools machinery etc necessary for the expeditions handling of the work.

1.02 SETTING OUT

A. The Contractor shall be required to employ an approved Licensed Surveyor who will set up the positions of the micropiles as shown in the micropile layout plans of the detailed design. The Contractor will be responsible for the accuracy of location and positioning of each micropile. Any errors in setting out and any consequential loss to the Owner will be made good by the Contractor to the satisfaction of the Engineer.

B. The Contractor shall preserve the pegs set out by the Surveyor. Should any peg be displaced or lost it must be replaced by a Licensed Surveyor to the approval of the Engineer. Upon completion of all piling works, the Contractor shall produce as-built Drawings showing the positions of all micropiles as installed. The positions of micropiles shall be verified by a Licensed Surveyor.

1.03 TOLERANCES

A. Position:

1. The micropile heads shall be positioned as shown on the Drawings within a maximum deviation of 1.5 in. in either direction from correct center point.

B. Verticality:

1. For micropiles, the maximum permitted deviation of the finished micropile from the vertical at any level is 1 in 150. The contractor shall demonstrate to the satisfaction of Engineer the micropile verticality is within the allowable tolerance.

C. Correction:

1. Should micropiles be installed outside these tolerances affecting the design and appearance of the structure, the Contractor shall propose and carry out immediate remedial measures to the approval of the Engineer.

1.04 PERSON IN CHARGE

A. The piling work is to be carried out by full-time operators and supervisory staff who must be experienced in the installation of the proposed type of micropiles.

B. The Contractor shall submit to the Engineer for approval, written evidence to show that the persons who will be engaged in the works have had such experience.

1.05 PILING EQUIPMENT AND ACCESSORIES

A. The equipment and accessories must be capable of safely, speedily and efficiently installing micropiles to the design requirements at the project site.

B. Sufficient units of equipment and accessories must be provided to keep to the agreed construction schedule.

1.06 SEQUENCE OF INSTALLATION OF PRODUCTION MICROPILES

A. The Engineer reserves the absolute right and the Contractor shall recognize such right to direct the installation of working micropiles in any sequence the Engineer deems necessary for the satisfactory completion of the works.

1.07 SUBMITTALS

A. Contractor to submit stamped and signed calculations and drawings by a licensed engineer registered to practice in the State of Texas to the Architect for approval.

PART 2 - SCOPE

2.01 SCOPE OF WORK

A. The contract comprises the provision of all labor, materials, tools, plant, etc. necessary for the following work.

1. Supply and installation of micropile foundations to carry the loads as specified in the drawings.
2. Stripping and cutting the micropiles to cut off levels specified and preparation of the micropile head as shown on the drawings.
3. Carrying out standard proof tests as specified.

PART 3 - EXECUTION

3.01 MATERIALS

A. Reinforcement:

1. The type of reinforcement to be used, the diameter and/or thickness, grade, yield strength and stress shall be as specified or as shown on the Approved Design.

3.02 GROUT

A. Unless otherwise specified, the grout shall be non-shrink cement grout. The grout mix design such as the water-cement ratio, the minimum cement and grout strength at 7 and 28 days shall be as specified and shown on the Drawings. Grout at placement shall have a specific gravity (G_S) within the range of 1.65 to 1.85. All grout shall have a minimum compressive strength of 4000 psi at 28 days. Grout shall be tested in accordance with ASTM C109 at a frequency of no less than one set of three (3) grout cubes from each grout plant each day of operation.

B. If admixtures are used, details of admixtures shall be submitted to the Engineer for approval before commencement of works. The use of the admixture shall fully comply with the manufacturer's instructions.

C. If the grout as tested fails to satisfy the criteria as prescribed in Specification and drawings, the micropiles constructed using this batch of grout shall be rejected. The Contractor shall undertake all necessary additional and consequential remedial/compensatory work to the approval of the Engineer.

3.03 SITE AND ADJACENT PROPERTIES

A. Subsurface Information

1. The subsurface information is provided only for information and guidance to the Contractor and shows the approximate nature of the strata as known to the Engineer. The Owner and Engineer shall not be liable for the accuracy of the data given and the Contractor may carry out his own subsurface investigation to obtain additional information.

B. Site Visit

1. The Contractor is advised to visit the site to acquaint himself with the site conditions and no claims for inadequate information regarding site conditions will be entertained at a later date. The system or systems put forward by the Contractor shall be well known. The adequacy of any system and its approval shall be at the discretion of the Engineers.

C. Underground Services and Adjacent Property

1. The Contractor shall take care to ensure the safety of underground services and adjacent properties during the installation of micropiles. The Contractor will be liable to any claims of damage due to the piling operations.

3.04 DRILLING OPERATIONS

A. Diameter of Micropiles.

1. The diameter of micropiles shall not be less than the designed diameter at any level throughout its length.

B. Drilling

1. The Contractor shall submit to the Engineer details of drilling equipment and drilling procedure for approval before commencement of works. Drilling operations shall be carried out in accordance with the relevant requirements as follows.

a. Boring near recently Cast Micropiles.

1) Micropiles shall not be bored within three (3) diameters (center-to-center) of other micropiles which have recently been cast less than 24 hours or contain unset grout, whichever longer, to avoid damage to any of these micropiles.

b. Stability of Drill holes

1) It is held that the Contractor has allowed in the unit rate of the micropile for the implementation of all necessary measures, including the provision of all materials, labor and plant, for maintaining the stability of the sides of boreholes during micropile installation and successful completion of the micropiles. The Contractor shall submit his proposed methods for agreement prior to commencement of boring operations.

2) Irrespective of the presence of groundwater, the sides of all boreholes shall be kept intact and no loose material shall be permitted to fall into the bottom of the boreholes. The Contractor's boring equipment shall be able to advance a steel casing to support the sides of all boring.

3) If the sides of boreholes are found to be not stable, temporary steel casing shall be driven into stable stratum. The borehole shall be filled with drilling fluid to a level sufficiently to stabilize the boreholes.

4) If groundwater is found in any hole in sufficient quantity or gushing out as to affect boring operations or excavations and removal of soil from the boreholes, or the sides of boreholes collapse, then a steel casing of appropriate size and length in conjunction with stabilizing fluid or other alternatives of sufficient strength shall be used to support the sides of the borehole and permit boring operations to proceed smoothly and safely. The proposed drilling fluid mix must be submitted to the Engineer for approval.

5) Excavations shall not be exposed to the atmosphere longer than is necessary and shall be covered at all times when work is not in progress. Micropiles excavated shall be cast that same work day unless otherwise agreed by the Engineer.

6) In the event of a rapid loss of drilling fluid from the borehole excavation and caused instability of bore, the excavation shall be backfilled without delay or other appropriate and approved remedial measures taken by the Contractor like installing temporary casing prior to resuming boring at that location. The cost of redrilling of the hole shall be borne by the Contractor.

c. Stability of bore by Temporary Casing Method

1) Where the use of a temporary casing is required to maintain the stability of a bore, the bottom of casing shall be kept a minimum of 3 ft or more below the

unstable strata to prevent the inflow of soil and the formation of cavities in the surrounding ground.

2) Temporary casings shall be thin walled mild steel cylindrical casing. The dimensions and quality of the casing shall be adequate to withstand without damage or distortion all handling, construction and ground stresses to which they will be subjected. The casings shall have an internal diameter not less than the specified micropile diameter. They shall be free of significant distortion, of uniform cross-section throughout each continuous length and free from internal projections and encrusted grout which might prevent the proper formation of micropiles. The joints of casings shall be watertight.

3) If temporary casings are damaged during installation in a manner which prevents the proper formation of the micropile, such casings shall be withdrawn from the bore before grout is placed, repaired if necessary, or other action taken as may be approved to continue the construction of the micropile.

3.05 GROUTING OPERATIONS

3.06 CONSTRUCTION OF MICROPILE HEADS

A. Lengthening of Micropiles.

1. Where lengthening is required, the micropile reinforcement unit shall be connected on site as per the details shown in the approved Contractor's work plan.
2. Other means of jointing reinforcement shall be to the approval of the Engineer.

B. Cutting and Preparation of Micropile Heads

1. Micropile heads shall be constructed to the details as shown as per the approved Contractor's work plan and/or on the Drawings.

3.07 STANDARDS

A. All materials shall be of the best quality and new. All piling work shall be executed in accordance with the approved designs prepared by the Contractor and to the approval of the Engineer.

B. Standard Verification Test

1. A verification test of at least two-and-one-half (2.5) times the working load shall be performed if such is included in the approved work plan. The intent of the verification test shall be to verify geotechnical capacity of the test micropile. The number and location of test micropiles shall be as stated in the approved work plan. The Contractor shall submit a detailed proposal of the verification tests to the Engineer and shall obtain his approval in writing before performing verification tests. On completion of the test(s), the Contractor shall submit to the Engineer the results including graphs showing load and settlement versus time and settlement versus load.
2. The test procedure shall be as specified in the approved work plan or Specifications. The acceptance criteria for micropile verification load tests are:
    a. The micropile shall sustain the compression and/or tension design loads (1.0 DL) with no more than 0.50 in. total vertical movement at the top of the micropile as measured relative to the top of the micropile prior to the start of testing. If an Alignment Load is used, then the allowable movement shall be reduced by multiplying by a factor of (DL-AL)/DL. (This conservatively accounts for the movement in reaching AL).
    b. At the end of a 2.0DL creep test load increment, test micropiles shall have a creep rate not exceeding 1mm per log cycle time (1 to 10 minutes) or 2mm per log cycle time (6 to 60 minutes). This creep rate shall be linear or decreasing throughout the creep load hold period.

C. Proof-Testing

1. Production proof-tests will be performed on at least 10 percent of the production micropiles. The maximum test load for production micropile proof-testing is 1.3 times the design load (DL

x 1.3). Proof-tests shall be made by incrementally loading the micropile in accordance with the following schedule, to be used for both compression and tension loading.

AL = Alignment Load, DL = Design Load		
	LOAD	HOLD TIME (MIN)
1	AL	1
2	0.25 DL	1
3	0.50 DL	1
4	0.75 DL	1
5	1.00 DL	1
6	1.33 DL	10 or 60 min creep test
7	1.33 DL (maximum test load)	1
8	AL	1

D. The acceptance criteria for micropile proof tests are:

1. The micropile shall sustain the compression and/or tension design loads (1.0 DL) with no more than 0.50 in. total vertical movement at the top of the micropile as measured relative to the top of the micropile prior to the start of testing. If an Alignment Load is used, then the allowable movement shall be reduced by multiplying by a factor of (DL-AL)/DL. (This conservatively accounts for the movement in reaching AL).
2. At the end of the 1.33DL creep test load increment, test micropiles shall have a creep rate not exceeding 1mm per log cycle time (1 to 10 minutes) or 2mm per log cycle time (6 to 60 minutes). This creep rate shall be linear or decreasing throughout the creep load hold period.
3. Failure does not occur at the 1.33DL maximum compression and/or tension loads. Failure is defined as the load at which attempts to further increase the test load simply result in continued micropile movement.

3.08 TEST REPORT

A. The report shall contain the following:

1. Micropile designation, date completed, weather condition, micropile length, micropile size, volume of grout intake, time of drilling at intervals not greater than 4m and time to grout the micropile.
2. Description of the apparatus used for testing, loading system and procedure for measuring settlement.
3. Field data.
4. Time/Settlement Curve
5. Load/Settlement Curve.
6. Remarks explaining unusual events or data and movement of micropiles.
7. Calibration certificates of dial gauges and pressure gauges.
8. The format of record shall be approved by the Engineer.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

3.09 DAMAGED OR DISPLACED MICROPILES

A. Should the deviation exceed the tolerance provided in this specification, the contractor shall submit this remedial proposal for the approval for the Engineer. Failing this, the faulty micropile shall be replaced by additional micropiles as necessary in positions as determined by the Engineer at no cost to the Owner. The cost of modification to micropile cap etc., if any, shall be borne by the Contractor. The same will also apply to any piling work rejected by the Engineer for not truly constructed and installed in accordance with the specification.

B. Where a micropile has been damaged during installation, testing or by other causes, the damaged micropile shall be considered and treated as a faulty micropile and should be replaced by additional micropiles as approved by the Engineer at the Contractor's expense.

C. Forcible Correction Not Permitted

1. Where micropiles have not been positioned within the specified limits no method of forcible correction will be permitted.

3.10 PAYMENT

A. Unconcreted (Empty) Bore

1. The unit rate of the micropile shall be deemed to include whatever empty bore above the cut-off level of the micropile and re-drilling after pre-grouting. No claims will be considered for any empty bore and re-drilling, and the Contractor shall allow in Contract for the cost of these processes due to the sequence of construction.

3.11 PAY LENGTH

A. For all proposed micropiles, the Contractor shall be paid only for the length of installed micropile measured from tip of the micropile to the cut-off level. The same applies for the grout. Pregrouting, grout loss, over drill, re-drilling will have to be borne by the Contractor and shall be deemed to have included in the rate.

3.12 PILING RECORDS

A. Complete piling records shall be kept by the Contractor during micropile installation. The Contractor shall submit the following in duplicate to the Engineer:

1. Records of all micropiles as the work proceeds.
2. Upon completion, a record of the work as carried out and as-built drawing.

B. The format of the record shall be approved by the Engineer.

C. The record shall contain all information required by the Engineer which includes the following where applicable.

1. Reference number and position of micropile.
2. type and dimension.
3. Date of boring and nature of strata where each micropile is bored
4. Details of equipment used
5. Ground level and base of excavation level
6. Total penetration
7. Time of drilling at intervals not exceeding 15 ft
8. Details of all splicing or jointing operations, locations of sleeves, etc.
9. Details of grouting operation for tremie grouting and time tables
10. Weather
11. Top level of micropile immediately after completion
12. Errors in position and inclination
13. Grout specific gravity

14. Amount of grout and the pressure used
15. Size and position of obstructions, if any, in each micropile
16. Detailed drilling speed (ft/min)
17. Description of drilled material

D. As-Built Drawings
   1. After completion of the piling, the Contractor shall submit an as-built drawing. This drawing should include the following:
      a. Size and type of micropiles.
      b. Eccentricities in both directions.
      c. Depth of penetration of each micropile or reduced level of tip of each micropile and cut-off level of each micropile.

END OF SECTION

SECTION 31 11 00

SITE PREPARATION & CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Removal of miscellaneous existing site appurtenances.
   2. Protection and/or removal of trees and other vegetation.
   3. Topsoil stripping
   4. Clearing, grubbing and mowing

1.2 RELATED REQUIREMENTS

Construction Drawings

1.3 PROTECTION

A. Provide protection necessary to prevent damage to existing improvements, trees, or vegetation light poles, power poles, fire hydrants, etc., indicated on the Contract Documents are to remain.

B. Protect improvements on adjoining properties and on Owner's property.

C. Restore damaged improvements to original condition as acceptable to parties having jurisdiction.

D. Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction. Streets and roadways shall be thoroughly cleaned and/or swept on a daily basis or more frequently as required by the governing authority.

E. Provide traffic control as required, in accordance with the U.S. Department of Transportation "Manual of Uniform Traffic Control Devices" and the state highway department requirements.

F. Unknown Utility Lines: All known utilities have been shown according to the information available. Contractor is responsible for coordinating with local utility companies and owner to locate and confirm all buried utilities in the construction area. Contractor is to notify Architect immediately if unknown lines, pipes, or other underground objects are encountered.

G. Mow and remove weeds and small undergrowth vegetation in the construction area as defined on the drawings.

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PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 GENERAL PROCEDURE

A. Unless otherwise indicated on the drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Dispose of off-site. Do not remove items elsewhere on site or premises unless specifically indicated. Notify Architect prior to clearing if any item called for as "removed by Owner" remains upon issuance of Notice to Proceed.

B. Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Cut heavy growths of grass from areas before stripping. Topsoil shall consist of sandy clay surfical soil found in depth of not less than 6". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones and other objects over 2" in diameter, weeds, roots, and other objectionable material.

C. Completely remove stumps, roots, and other debris below proposed subgrade elevation. Fill depressions caused by clearing and grubbing operations with satisfactory soil material as per requirements of Section 31 23 00 unless further excavation or earthwork is required.

D. Remove existing above grade and below grade improvements and abandoned underground piping or conduit necessary to permit construction and other work.

E. Retain boxing and protection for items to remain in construction until finish grade is completed. Repair any damage that occurs to these items without expense to the Owner.

END OF SECTION

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SECTION 31 20 00 - EARTH MOVING

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. Excavating and filling for rough grading the Site.
2. Preparing subgrades for turf and grasses and plants.

B. Related Requirements:
1. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

B. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Landscape Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Landscape Architect. Unauthorized excavation, as well as remedial work directed by Landscape Architect, shall be without additional compensation.

C. Fill: Soil materials used to raise existing grades.

D. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
1. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

E. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

H. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

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

1. Review methods and procedures related to earthmoving, including, but not limited to, the following:

a. Personnel and equipment needed to make progress and avoid delays.
b. Coordination of Work with utility locator service.
c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
d. Extent of trenching by hand or with air spade.
e. Field quality control.

1.5 INFORMATIONAL SUBMITTALS

A. Preexcavation Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Landscape Architect.

C. Utility Locator Service: Notify "Call Before You Dig" for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 015000 "Temporary Facilities and Controls" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - EXECUTION

2.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

2.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2.3 EXPLOSIVES

A. Do not use explosives.

2.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

B. Excavation in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only roots smaller than ½" diameter unless authorized by Landscape Architect.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

2.5 STORAGE OF SOIL MATERIALS

A. Stockpile excavated soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Remove excavated material as soon as practical. Materials may not remain on site for long periods.

2.6 BACKFILL

A. Place backfill in excavations promptly, but not before removing trash and debris.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

2.7 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

2.8 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

2.9 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
1. Under turf or planted areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.

2.10 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
3. Unless otherwise directed, restore filled areas to original grades.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.

2.11 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Landscape Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

2.12 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 31 22 00

SITE GRADING

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 31 23 00, Excavation and Backfill.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Do all cutting, filling, compacting, and rough grading required to bring entire project area within the limits of construction shown to indicated grades.

B. Subgrades should be consistent with finish grades shown, allowing for an uniform layer of topsoil, properly graded to drain away from the building. Provide smooth ditches or swales as shown to carry water away from the project area without standing.

C. Contractor shall be responsible for setting all grades and slope stakes; and locating all buildings, drives, parking areas, walks and other site items as shown on drawings.

D. Control grading operations to prevent water from running into excavated areas.

3.2 ENVIRONMENTAL REQUIREMENTS

A. Construct temporary erosion control systems as shown on Construction Drawings or as directed by “Storm Water Pollution Prevention Plan” (SWPPP) to protect adjacent properties and water resources from erosion and sedimentation.

B. In event that site work on this project will disturb 0.5 or more acres, Contractor shall not begin construction without posting on site the “National Pollution Discharge Elimination System” (NPDES) permit governing discharge of storm water from site for entire construction period. NPDES permit requires SWPPP to be in place during construction. Contractor shall submit the Notice of Intent (NOI) for sites over 5 acres in disturbance to the States Department of Environmental Quality for permit before starting work.

C. Contractor shall be totally responsible for conducting storm water management practices in accordance with NPDES permit and for enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor’s failure to comply with provisions of NPDES permit.

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D. All grading operations are operations that are to be in strict compliance with the provisions of the Arkansas Water and Air Pollution Control Act Act 472 of 1949 as amended, AR Ann. 8-4-101 et seq.), and the Federal Clean Water Act 33 U.S.C. 1251 et. seq. Contractor shall be responsible for submitting application to state authority and obtaining permits.

E. It shall be the Contractor's responsibility to comply with current OSHA and other local, state, and federal requirements for all excavation and fill operations, and other areas of the work.

F. Contractor to keep dust on site to a minimum the entire duration of construction by means of regular watering. This will include dust created by grading operations, vehicular traffic, and wind.

END OF SECTION

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SECTION 31 23 00
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Furnish labor and materials for all work under this section.

1.2 RELATED SECTIONS

A. Section 00 42 13 – Proposal for Lump Sum Contract: Unit Prices

B. Section 01 22 13 – Measurement & Payment

C. Section 01 40 00 – Quality Control: Required Special Inspections

D. Section 02 32 00 – Earthwork

E. Section 03 30 00 – Cast-In-Place Concrete

F. Section 31 11 00 - Site Preparation

G. Section 31 22 00 - Site Grading

H. Section 32 11 16 - Crushed Stone Base Course

I. Section 32 92 19 – Seeding

J. Section 32 92 20 – Hydroseeding

K. Section 32 92 23 – Sodding

1.3 SOILS VERIFICATION

A. The **Contractor** shall be responsible for having Building and Earth, the registered soils engineer, present on site to examine and conduct tests of soils preparation and construction per IBC required special inspections including filling and grading. The soils engineer shall inspect excavations for foundations, footings, and paving areas perform bearing testing, and will submit a report to general contractor with a copy to the Architect stating conditions observed meet or exceed the limits found in the specifications and are consistent with acceptable construction practices. Construction shall not begin before report is received by the Architect. **Contractor** shall be responsible for any costs for meeting these requirements. **Contractor** shall coordinate inspections, testing, and observation with soils engineer.

PART 2 PRODUCTS

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NOT USED

PART 3 EXECUTION

3.1 TOPSOIL AND UNSUITABLE SOILS EXCAVATION

A. Strip off topsoil and unsuitable fill material (refer to soils report), at new building, paving, drives and equipment pad areas. Remove all vegetation, rocks, and any soft soils. Haul away and dispose of unsuitable fill material and excess excavated topsoil material off site. **–OR-** Stock pile topsoil on-site as instructed in specification Section 31 11 00. Excavate to minimum thicknesses as follows:
   1. Building Pad: 2’-0”
   2. Paving Areas: 2’-0”
   3. Equipment Pads: 2’-0”
   4. Retaining walls: 2’-0”

   At footings, excavate as required to provide 12 inches of engineered fill beneath footings.

B. After stripping unsuitable soils as described in soils report to required depth (refer to “Preparation Of Original Earth” section), the entire building area, drives, walks, and all areas to be paved shall be proof-rolled with a loaded rubber-tired tandem-axle dump truck or scraper weighing at least 25 tons, and any soft soils are to be undercut and replaced with properly compacted fill. Soils engineer shall be present when proof rolling is being performed.

C. After proofrolling, scarify to a depth of at least 6” adjusting the moisture content to within 2 percent of optimum moisture content, then compacted to specified density.

D. Retain sufficient topsoil on site to accomplish final grading.
   -*OR-*
D. Store topsoil on site per section 31 11 00.
   -*OR-*
D. Store sufficient quantity of topsoil on site per section 31 11 00 to accomplish final grading for building phase. *(Use for grading [portion of a 2-part contract-Delete if single building contract.)*

E. Use no topsoil for compacted fill inside building perimeter.

F. Use no on-site excavated material for fill inside building perimeter, below footings, or behind retaining walls.

G. If insufficient topsoil on site, furnish good topsoil, approved by Landscape Architect, for finish grading and planting areas.

3.2 EARTH EXCAVATION

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A. Excavation for walks, pavements, curbs, gutters, roof drainage, conductors, retaining walls, building volume below grade, underfill below slabs on grade, foundation walls, footings and other items indicated by drawings or otherwise necessary for construction.

B. Excavate to elevations and dimensions indicated, plus minimum, yet sufficient, space to permit erection of forms, shoring, drain tile waterproofing, masonry and the inspection of foundations.

C. Dress earth banks and bottoms for footings forms. Bear footings on engineered fill - OR - undisturbed soil at elevations shown on drawings.

D. Insure all exterior footing excavations are below frost line at a minimum of 24" below final finish grade.

E. If footings occur in poor materials at footing depths indicated (as determined by soils engineer), over excavate as required and compact with approved fill compacted to 95% of standard Proctor density (ASTM D-698).

F. Remove any existing foundations, footings, piers, and other construction found in the area of new construction.

G. Material to be excavated is assumed to be earth and other materials that can be removed with a Caterpillar D-8 Dozer with single tooth ripper (mass grading), a Caterpillar 330B tracked excavator equipped with rock teeth (utility trenches) or equipment of similar power and capability. If unanticipated rock is encountered within limits of excavation, contractor shall immediately notify Architect and not proceed further until instructions are given and measurements made for purpose of establishing volume of rock excavation. Rock is defined as any stone or boulders that cannot be removed with the use of a Caterpillar D-8 Dozer with single tooth ripper (mass grading), a Caterpillar 330B tracked excavator equipped with rock teeth (utility trenches) or equipment of similar power and capability.

H. Only as a last resort, should explosives be used. Should explosives be necessary, work shall be done by experienced powder men using small charges and in strict accordance with all regulations governing this work. Contractor secure permits required for such work and correct any damage to foundations and/or property caused by improper use of explosives at his expense. Architect to be notified and approval granted before explosives are allowed.

I. Specifically notify Architect and Geotechnical Engineer to inspect excavations, and receive his approval before placing concrete.

J. Provide unit price for rock excavation on Bid Form. Rock shall be measured per cubic yard for rock in place. This shall include associated costs for quantity verification by Geotechnical or Civil Engineer.

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K. Provide unit prices for engineered fill/placement/compaction and existing earth excavation/removal/haul-off in spaces provided on Bid Form. This shall include associated costs for quantity verification by Geotechnical or Civil Engineer. These unit prices are for Owner's information only. Provide all fill and cut in contract as required to meet requirements shown on drawings and specifications.

3.3 PREPARATION OF ORIGINAL EARTH

A. Floor slab areas should be stripped of all surface vegetation, topsoil and unsuitable soil to depths as called for in paragraph 3.1. Any soft or unstable materials should be removed and replaced with engineered fill. The subgrade, exposed after stripping and completing any cuts, should be scarified to a minimum depth of 8 inches and moisture conditioned to level within 2 percent of the materials' optimum moisture content. The subgrade should then be compacted to at least 98 percent of the material's maximum laboratory dry density determined in accordance with ASTM Specification D-698, the Standard Proctor procedure.

B. Remove all topsoil below areas to receive sidewalks. Bear concrete sidewalks on natural earth or minimum 12" engineered fill as required to meet elevations as shown on grading plan.

3.4 FILL MATERIAL AND GRADING

A. Place a minimum 12" layer of imported engineered fill material beneath the slab. Thickness as required to meet subgrade elevations is in addition to granular under slab fill.
OR
Place imported engineered fill material beneath the slab. Thickness as required to meet subgrade elevations is in addition to granular under slab fill.

B. Place imported engineered fill materials for paving areas (24" for asphalt parking areas and drives, 24" for concrete paved areas) to levels indicated on site plan. Compact as specified.

B. Bear concrete sidewalks on natural earth or minimum 12" engineered fill as required to meet elevations as shown on grading plan. Thickness as required to meet subgrade elevations is in addition to 4"granular under slab fill.

C. Footings to bear on minimum 1'-0" thick engineered fill. The over excavation of existing low strength materials should extend a sufficient distance beyond the edge of the building such that the engineered fill placed beneath footings will extend laterally beyond the edge of the footing at least 8 inches for each 12 inches of engineered fill placed beneath the footing.

D. At Contractor's option, the on-site soils could be modified with lime to reduce their plasticity. The actual percentage required is to be determined in the field by a qualified Geotechnical Engineer as the amount necessary to reduce the plasticity index(PI) of the

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lean to fat clay soils to less than 18 percent. Refer to proposal form for unit pricing. This is for owner's use only in determining any additional soil modification. If soil modification is selected by contractor as option, it will be priced inclusive in project.

E. Excavations resulting from the removal of existing site features should be cleaned of loose material and properly back filled as recommended in this report.

F. If Geotechnical Engineer determines less fill material or more is required, it shall be provided or deducted from contract. Refer to proposal form for unit pricing.

G. In general, place no interior or exterior fills less than 3 days after concrete forms for structure have been removed, and then only when approval is received from Architect.

H. Place fill in layers not exceeding 8" in loose thickness, thoroughly compacting with powered tamp. Moisture content of fill material is to be controlled to between 2 percent below and 3 percent above optimum as determined by ASTM D698. Compact fill material to a minimum of 95 percent of the maximum Standard Proctor dry density, ASTM Specification D-698.

I. All imported engineered fill to consist of approved, low to moderate plasticity silty clay material that is free from organic matter and debris. Engineered fill shall have liquid limits less than 46 and a plasticity index of at least 16 and less than 26 with exception of the upper 2'-0" at the floor slabs, which should have a liquid limit of less than 40, and a plasticity index of less than 20. Locally available clayey gravel (hillside) materials could be used, but should be approved prior to their use. No rock greater than 6" shall be allowed in fill material. Submit test results of fill material from borrow pit proposed for use to Engineer for approval prior to procurement.

J. Final fill under concrete floor slabs shall consist of 4 inches of granular sub-base material immediately below the concrete floor slab. Refer to Section 32 11 16 for base requirements below paving areas. The sub-base material shall be clean, washed, crushed limestone conforming to ASTM C33, Size 57, or equal spread level to allow for minimum required concrete thickness. The upper portion (approximately 2 inches) to be "choked" off with limestone fines or sand. Tamp tightly into place, prior to placement of termite treatment and vapor barrier.

K. Backfill around foundations, grade beams, and retaining walls with debris-free earth having no stones larger than 3" and no frozen materials. Take precautions not to damage waterproofing membrane. Repair any damage to same.

L. Roll, tamp and otherwise compact other site fill.

M. Cut and fill with debris-free earth to bring lawn areas affected by this construction to approximately 4" below finish grades. Grade uniformly between elevations give and "round-out" any abrupt changes in slope during final grading operations.

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N. Haul in additional earth required. Should there be an excess of excavated material, haul it to area off site. *–OR-* Store excess excavated material on site where directed by owner.

O. Haul away and dispose of any surface rubble and debris.

P. Remove any groundwater accumulated in excavations prior to placement of concrete. Soils Engineer to verify conditions are acceptable and bearing capacity is at or exceeds specified bearing pressure

3.5 SHOT ROCK MATERIAL AND INSTALLATION
(Use only when recommended by Geotechnical Engineer and approved by Engineer)
(Provide Unit Price in space provided on Proposal Form.)

A. Shotrock shall be quarried sandstone,, Limestone, or other hard durable stone with a percent wear no greater than 50% by Los Angeles Test (AASHTO T 96) with angular or fractured faces with pieces no greater than 12-14 inches in any dimension, more than 40% greater than 8 inches in size, 10-30% passing the 3 inch sieve and no more than 15% passing the 0.5 inch sieve.

Screen Size	% Passing
12-14 inch	100
8 inch	60-100
3 inch	10-30
0.5 inch	0-15

B. Excavate to the planned depth.

C. Place first shot rock layer no deeper than the largest rock.

D. Force the shot rock into the soft soil until it becomes buried or refuses to penetrate into the soil.

E. Perform additional layers as described in #C and #D above until the shot rock is no longer accepted by the soil (this operation should be witnessed by the inspector).

F. Place and compact 1 inch base rock on top of the stabilized shot rock to fill any voids present.

G. Continue with planned construction.

3.6 CONTROLLED LOW STRENGTH MATERIAL (CLSM) / FLOWABLE FILL AND INSTALLATION
(Use only when recommended by Geotechnical Engineer and approved by Engineer)
(Provide Unit Price in space provided on Proposal Form.)

A. CLSM fill to be 150 PSI minimum or meeting DOT specifications.

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B. Excavate or over-excavate unsuitable soil per soils engineer's instruction to the required depth.

C. Following verification of required bearing by soils engineer, place CLSM to proper depth for footing bearing elevation

D. Construction shall continue after material has taken initial set, is stable, and does not displace under equipment; minimum of 24 hours.

3.7 TOPSOIL

A. After rough grading is completed and approved, scarify subsoil in areas to be lawns to a depth of 4" and place a layer of topsoil there over, providing additional topsoil required to give thickness specified.

B. Topsoil material: Fertile, natural topsoil, typical of locality, free from stones, debris, clay and weeds.

C. Topsoil minimum thicknesses: 4" seeded and sodded areas, 12" landscaped areas. (Adjust final cut and fill depth as required to accommodate lawn type.)

D. Fill to finish grade indicated, eliminate water pockets and irregularities, ready to receive seed or sod.

E. Finish site grading to be smooth throughout contours. Abrupt changes, uneven, or undulating grading will not be accepted unless shown as such on grading plan.

3.8 EXTENT OF FINISH GRADING

A. Cut, fill and grade to extent of contours and elevations indicated by drawings.

B. At building perimeter, keep finish grades generally 6" below finish floor elevation with exception of areas at drives and walks.

3.9 QUANTITY VERIFICATION

A. Contractor to be responsible for costs incurred by Surveyor and/or Geotechnical Engineer, or other qualified individuals to verify quantity of rock or additional unsuitable soil removed. This shall be included in the unit price costs.

3.10 OBSERVATION AND SPECIAL INSPECTIONS

A. Soils cut and fill operations shall be observed periodically by the Geotechnical Engineer and Architect prior to placing of concrete footings and slabs, and paving. Inspection of soils bearing pressure, verification of soils, and cut/fill operations for conformance to the construction documents and IBC shall be performed by the designated third party Special Inspector.

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3.10 TEST REQUIRED:

Contractor shall coordinate compaction tests on the building and paving areas from a recognized Geotechnical Engineer, approved by the Architect, at the following intervals. Contractor is to pay for compaction testing. **Location of each test shall be noted on report.**

A. Minimum three tests per each layer of fill placed, one per each 2,500 sq. ft. of building area.

B. Minimum three tests per each layer of fill placed, one per each 5,000 square feet of pavement area.

C. Density testing of any gravel or crushed stone base course with fines or any over-excavated footing is to be compacted to a minimum of 95 percent of the maximum Standard Proctor dry density, ASTM Specification D-698.

D. If any test results fall below required minimum, the testing company is required to contact Contractor and Architect immediately.

END OF SECTION

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SECTION 31 25 00

STORM WATER POLLUTION PREVENTION PLAN

PART 1 GENERAL

1.1 SCOPE

A. **PURPOSE OF SWPPP:** This SWPPP covers the storm water management practices that the Construction Manager shall employ in accordance with the NPDES permit governing storm water discharges during construction, and in accordance with erosion control practices specified in other sections.

B. The Construction Manager will be responsible for securing and maintaining the SWPPP Plan.

C. Storm Water Pollution Prevention Plan (SWPPP)
   1. The SWPPP report is bound in this specification for reference only.
   2. See the drawings for the large format sections of the report.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

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SECTION 32 11 16
CRUSHED STONE BASE COURSE

PART 1 GENERAL

1.1 SCOPE

A. This Section covers the materials for crushed stone base course to be used as a base material for asphaltic paving.

B. This material may also be used for embedment for water and sewer utility lines.

1.2 RELATED WORK

A. Section 31 23 00: Excavation and backfill-filling and site preparation for streets and parking areas.

B. Section 32 12 16: Asphaltic Concrete Paving

C. Standard Specification for Highway Construction, ArDOT

1.3 QUALITY ASSURANCE

A. The moisture density relations of material shall be determined in the laboratory in accordance with AASHTO T-180.

B. Compacted base shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and re-compacting to the specified density, as directed.

1.4 PUBLIC WORK

A. Comply with the City of Rogers, AR, standard specifications for Public Street Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

PART 2 PRODUCTS

2.1 MATERIALS

A. Crushed stone base course shall consist of crusher run stone or a mixture of crushed stone and natural fines uniformly mixed and so proportioned as to meet all the requirements hereinafter specified, with the further provision that a mixture of crushed stone and natural fines shall contain not less than 95 percent crusher produced material.

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B. Stone shall be hard and durable with a percent of wear by the Los Angeles Test (AASHTO T96) not greater than 45.

C. Shale and slate shall not be used for crushed stone base course.

D. The material furnished shall not contain more than 5 percent by weight of shale, slate and other deleterious matter.

E. Crushed stone base course shall conform to the following grading (AASHTO T 11 and T 27) and crushing (ArDOT) requirements.

Size of Sieve	Percent Passing by Weight
	Class 7
1-1/2"	100
1"	60-100
3/4"	50-90
3/8"	
#4	25-55
#10	
#40	10-30
#200	3-12

1. The fraction passing the No. 200 sieve shall not be greater than three quarters the fraction passing the No. 40 sieve. The fraction passing the No. 40 sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6.

2. When it is necessary to blend two or more materials, each material shall be proportioned separately by weight through mechanical feeders to insure uniform production. Pre-mixing or blending in the pit to avoid separate feeding will not be permitted.

3. The specific type of crushed stone for different applications shall be as specified or shown on Drawings.

PART 3 - EXECUTION

3.1 BASE COURSE

A. The base course material shall be placed on the completed and approved subgrade, that has been bladed to substantially conform to the grade and cross section shown on the Drawings.

B. The sub-grade shall be prepared as specified and shall be free from an excess or deficiency of moisture at the time of placing the base course.

C. The subgrade shall also comply, where applicable, with the requirements of other items that may be contained in the contract that provide for the construction, reconstruction or shaping of the subgrade or the reconstruction of the existing base course.

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D. Base course material shall not be placed on a frozen subgrade.

D. The crushed stone shall be placed on the subgrade or previous base course layer in lifts not to exceed 4" and spread uniformly to such depth and lines that when compacted it will have the thickness as follows:
   1. Flexible Paving Areas: 8" base course
   2. Rigid Pavement: 4" base course.

F. The spreading shall be done the same day that the material is hauled, and shall be performed in such a manner that no segregation of coarse and fine particles nor nests or hard areas caused by dumping the crushed stone on the subgrade will exist.

G. To insure proper mixing, the crushed stone shall be bladed across the roadbed before being spread. Care must be taken to prevent mixing of subgrade or shoulder material with the base course material in the blading and spreading operation

H. The crushed stone shall be substantially maintained at optimum moisture during the mixing, spreading, and compacting operations, water being added or the material aerated as may be necessary.

I. The specified grade and section shall be maintained by blading throughout the compaction operation.

J. The material in each course shall be compacted to a density, as determined by AASHTO T 238, Method B, of not less than 95% of the maximum laboratory density determined in the laboratory by AASHTO T 180, Method D. The aggregate shall be compacted across the full width of application.

K. The crushed stone shall be compacted across the full width of application.

L. The compacted base course shall be tested for depth and any deficiencies corrected by scarifying, placing additional material, mixing, reshaping, and re-compacting to the specified density, as required by the Architect.

M. Compaction testing shall be as specified in Section 31 23 00

END OF SECTION

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SECTION 32 13 13
PORTLAND CEMENT CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Arkansas Highway and Transportation Department; specifications and those noted on the drawings shall supersede respective items contained in this section.

B. Related Sections:

Section 31 23 00:	Earthwork
Section 32 11 16:	Crushed Stone Base Course
Section 03 11 00:	Concrete Form Work
Section 03 21 00:	Concrete Reinforcement
Section 03 30 00:	Cast-in-Place Concrete
Section 07 92 00:	Joint Sealant

1.2 PROJECT CONDITIONS

A. Traffic Control:
Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Utilize flagmen, barricades, warning signs, and warning lights as required.

1.3 REFERENCES

A. ArDOT specifications

1.4 PUBLIC WORK

A. Comply with the City of Bentonville's, standard specifications for Public Street and Entry Drive Construction. If a conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

PART 2 PRODUCTS

2.1 MATERIALS

A. Forms:
1. Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.
2. Use flexible spring steel forms or laminated boards to form radius bends as required.
3. Form Release Agent: Coat forms with non-staining type coating that will not discolor or deface surface of concrete.

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B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185. Furnish in flat sheets, not rolls.

C. Reinforcing Bars: Deform steel bars, ASTM A 615, Grade 40.

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Joint Fillers: Resilient pre-molded bituminous impregnated fiberboard units complying with ASTM D 1751 FS HH-F-341, Type II, Class A; or AASHTO M 153, Type I.

F. Curing Compound: FS TT-C-800, with a minimum of 17% solids content.

2.2 MIXING

A. Concrete Mix, Design and Testing: Comply with requirements of applicable Section 03 30 00 for concrete mix design, sampling and testing, and quality control.

B. Design mix to produce normal weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (super-plasticizer), air-entraining admixture and water to produce following properties:

C. Compressive Strength: 3,500 psi, minimum at 28 days or per the plans, whichever is greater.

GEOTECHNICAL REPORT refers to ArDOT standards as listed below:

D. Slump Range: 1”-4”

E. Air Content: 6% ± 2%.

PART 3 EXECUTION

3.1 PREPARATION

A. Surface Preparation: Remove loose material from compacted base material surface immediately before placing concrete.

B. Proof-roll prepared base material surface to check for unstable areas. The paving work shall begin after the unsuitable areas have been corrected and are ready to receive paving. Compaction testing for the base material shall be completed prior to the placement of the paving.

3.2 CONCRETE INSTALLATION

A. Form Construction:

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1. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
2. Check completed form work for grade and alignment to following tolerances:
3. Top of forms not more than 1/8" in 10'-0".
4. Vertical face on longitudinal axis, not more than 1/4" in 10'-0".
5. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.
6. Reinforcement: Locate, place, and support reinforcement as specified in Division 3 sections.

C. Concrete Placement:
1. Paving thicknesses are as follows per the geo technical report:
Heavy Duty Paving: 6" concrete.
Standard Duty Paving: 5" concrete.
2. Comply with requirements of Section 03 30 00 for mixing and placing concrete.
3. Do not place concrete until base material and forms have been checked for line and grade. Moisten base material if required to provide uniform dampened condition at time concrete is placed. Concrete shall be placed around manholes or other structures until they are at the required finish elevation and alignment.
4. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement or side forms. consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.
5. Deposit and spread concrete in continuous operation between transverse joints, as far as possible. If interrupted for more than 1/2 hours, place construction joint.

3.3 JOINT CONSTRUCTION

A. Provide joints as shown on drawings and as specified, but in no case exceed requirements of ACI 302.1R and 316R code requirements.

B. Construction expansion, weakened-plan (contraction),and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

C. Weakened-Plan (Contraction) Joints: Provide weakened-plane(contraction) joints, sectioning concrete into areas at 15'-0" o.c. maximum each way. Construct weakened-plane joints for depth equal to at least 1/4 concrete thickness, as follows:

D. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with recommended cutting tool and finishing edges with jointer.

E. Sawed Joints: Form weakened-plane joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

F. Construction Joints:

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1. Place concrete joints at end of placements and at locations where placement operations are stopped for period of more than 1/2 hour, except where such placements terminate at expansion joints.
2. Construct joints using standard metal keyway-section forms.

G. Expansion Joints:
1. Provide pre-molded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects.
2. Locate expansion joints at 60'-0" o.c. maximum for each pavement lane.

H. Joint Fillers:
1. Extend joint fillers full-width and depth of joint, and not less than 1/2" or more than 1" below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
2. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where more than one length is required, lace of clip joint filler sections together.

I. Joint Sealants:
1. Exterior pavement joint sealants shall composed of a non-priming, pourable, self-leveling type of a coal tar modified polyurethane, or a polyurethane, sealant suitable for use in pavements and sidewalks.

3.4 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with 10`-0" straightedge. Distribute concrete as required to remove surface irregularities, and re-float repaired areas to provide continuous smooth finish.

C. Work edges of slabs, back top edge of gutter, and formed joints with an edging tool, and round to 1/2" radius. Eliminate tool marks on concrete surface.

D. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, as follows:

1. Broom finish by drawing fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide fine line texture. Inclined Slab Surfaces: Provide coarse, non-slip finish by scoring surface with stiff-bristled broom perpendicular to line traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed.

F. Protect and cure finished concrete paving using acceptable moist-curing methods.

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3.5 CLEANING AND ADJUSTING

A. Repair or replace broken or defective concrete, as directed.

B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials.

C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just prior to final inspection.

3.6 TESTING AND SAMPLING:

A. Slump Tests: A minimum of two slump tests shall be made each day concrete is placed with one test being made at the time test cylinders are made. Slump tests are to be made in accordance with "Method of Test for Slump of Portland Cement Concrete" (ASTM C-143-78). Where slump exceeds five inches (5") or the average 28 day strength of the three test specimens falls below the strength specified (3000 p.s.i.) for the class of concrete tested, or below proportional minimum 7 day strengths, (2,400 psi) the proportions, water content or temperature conditions shall be changed to secure the required properties, and, at the discretion of the Architect, portions of the structure containing such concrete shall be removed and replaced, or reinforced as necessary.

B. Strength Tests: Compression strength test shall be performed in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C39-81). Samples for concrete cylinders shall be made in accordance with "Method of Sampling Fresh Concrete" (ASTM C172-82), and test cylinders shall be prepared and laboratory cured in accordance with "Method of Making and Curing Concrete Compression and Flexture Test in the Field" (ASTM C31-69).

C. Cylinders: Three cylinders from the same batch shall be made for each 50 cubic yards or fraction thereof placed, but not less than three cylinders for each day of concrete operations shall be made. Location of batch as to placement on the subject shall be noted, and cylinders so designated. No tests shall be required for sidewalks. One cylinder shall be tested at 7 days and two at 28 days.

D. A minimum of 9 cylinders shall be tested for each class of concrete used on the project and the average of any three consecutive strength tests at 28 days shall be equal to or greater than the specified strength. Result of any individual strength test shall not be less than 500 p.s.i. of required fc.

E. Contractor shall bear expense of all testing by a recognized licensed engineer.

END OF SECTION

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SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Joint-sealant backer materials.
3. Primers.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Concrete pavement joint sealants.
2. Joint-sealant backer materials.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of joint sealant.

C. Samples for Verification: Actual sample of finished products for each kind and color of joint sealant required.

1. Size: Joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisorsd who are trained and approved by manufacturer.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Performed by a qualified testing agency.

1.6 FIELD CONDITIONS

A. 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 or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backer materials, 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. Joint sealants shall demonstrate acceptable tamper-resistant properties, including the following characteristics:

1. Tear strength: 45-55ppi
2. Tensile strength: 250psi

C. Products:

1. DynaFlex SC Tamper Resistant Security Adhesive Sealant by Pecora, Harleysville, PA.
2. Approved equal.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or 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.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backers to support joint 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 joint-sealant backer materials.
2. Do not stretch, twist, puncture, or tear joint-sealant backer materials.
3. Remove absorbent joint-sealant backer materials that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backer material installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact 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.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants in accordance with the following requirements 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 joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. 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 and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.5 PAVING-JOINT-SEALANT SCHEDULE

A. Joints within concrete paving:

1. Joint Location:

    a. Expansion and isolation joints in concrete paving.
    b. Contraction joints in concrete paving.
    c. Other joints as indicated.

2. Joint Sealant: Multicomponent, nonsag, urethane, elastomeric joint sealant.
3. Joint-Sealant Color: Manufacturer's standard.

END OF SECTION 32 13 3

SECTION 321400 - UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Limestone Pavers
2. Brick Pavers
3. Granite Pavers
4. Stone Slab Paving
5. Curbs and Edge Restraints

B. Related Requirements:

1. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers, and for cast-in-place concrete curbs and gutters serving as edge restraints for unit pavers.
2. Section 03 35 23 “Exposed Aggregate Concrete Finishing” for exposed aggregate concrete applications.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For materials other than water and aggregates.

B. Sieve Analyses: For aggregate setting-bed materials, according to ASTM C136.

C. Samples for Initial Selection: For each type of unit paver indicated.

1. Two pavers.
2. Joint materials involving color selection.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Adhesion and Compatibility Test Reports: From latex-additive manufacturer for mortar and grout containing latex additives.

C. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store liquids in tightly closed containers protected from freezing.

1.6 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed:

1. Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry.
2. Apply asphalt adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

C. Weather Limitations for Mortar and Grout:

1. Cold-Weather Requirements: Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
2. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6. Provide artificial shade and windbreaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and higher.

a. When ambient temperature exceeds 100 deg F, or when wind velocity exceeds 8 mph and ambient temperature exceeds 90 deg F,

set pavers within 1 minute of spreading setting-bed mortar.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.2 PRODUCTS

A. UNIT PAVERS

1. Face Size and Shape:

    a. As indicated.

2. Color: As selected by Architect from manufacturer's full range.

B. LIMESTONE PAVERS (PA-8)

1. Size: 24”x24”x2 ¼”
2. Color: Prairie Shell
3. Vendor: US Stone, 2561 Q Ave, Herington, KS 67449, or approved equal.
4. Finish: Honed

C. LIMESTONE PAVERS (PB-8)

1. Size: 24”x24”x2 ¼”
2. Color: Cottonwood
3. Vendor: US Stone, 2561 Q Ave, Herington, KS 67449, or approved equal.
4. Finish: Honed

D. LIMESTONE PAVERS (PC-8)

1. Size: 36”x12”x2 ¼”
2. Color: Cottonwood
3. Vendor: US Stone, 2561 Q Ave, Herington, KS 67449, or approved equal.
4. Finish: Honed

E. LIMESTONE PAVERS (PD-8)

1. Size: 36”x18”x2 ¼”
2. Color: Cottonwood
3. Vendor: US Stone, 2561 Q Ave, Herington, KS 67449, or approved equal.
4. Finish: Honed

F. BRICK PAVERS (P-5)

1. Size: 21/4” x 4”x 8”
2. Color: Burgundy
3. Vendor: Endicott Clay Products, endicott@endicott.com, or approved equal.
4. Finish: Wire cut

G. GRANITE UNIT PAVERS PEDESTRIAN (P6)

1. Size: 4”X4”X2”
2. Color: Moonlit Rose
3. Vendor: Williams Stone, 1158 Lee Westfield Rd, East Otis MA, or approved equal.
4. Finish: Hammered

H. GRANITE UNIT PAVERS VEHICULAR (P7)

1. Size: 4”X4”X3”
2. Color: Moonlit Rose
3. Vendor: Williams Stone, 1158 Lee Westfield Rd, East Otis MA, or approved equal.
4. Finish: Hammered

I. RECLAIMED STONE PAVING

1. Size: natural, refer to drawings. Minimum 2’-0” x 3’-0”
2. Thickness: 3 inches – variable due to natural material
3. Color: natural beige
4. Finish: Natural cleft
5. Source: Native Arkansas river/ field slabs

2.3 MORTAR SETTING-BED MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II.

B. Sand: ASTM C144.

C. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed, and not containing a retarder.

D. Water: Potable.

E. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch in diameter; comply with ASTM A1064/A1064M except for minimum wire size.

2.4 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, made of white or gray cement and

white or colored aggregate as required to produce color indicated.

B. Grout Colors: As selected by Architect from manufacturer's full range.

C. Water: Potable.

2.5 MORTAR AND GROUT MIXES

A. General: Comply with referenced standards and with manufacturers' written instructions for mix proportions, mixing equipment, mixer speeds, mixing containers, mixing times, and other procedures needed to produce setting-bed and joint materials of uniform quality and with optimal performance characteristics. Discard mortars and grout if they have reached their initial set before being used.

B. Mortar-Bed Bond Coat: Mix neat cement and latex additive to a creamy consistency.

C. Latex-Modified, Portland Cement Setting-Bed Mortar: Proportion and mix portland cement, sand, and latex additive for setting bed to comply with written instructions of latex-additive manufacturer and as necessary to produce stiff mixture with a moist surface when bed is ready to receive pavers.

D. Latex-Modified, Portland Cement Bond Coat: Proportion and mix portland cement, aggregate, and liquid latex for bond coat to comply with written instructions of liquid-latex manufacturer.

E. Job-Mixed Portland Cement Grout: Proportion and mix job-mixed portland cement and aggregate grout to match setting-bed mortar except omit hydrated lime and use enough water to produce a pourable mixture.

1. Pigmented Grout: Select and proportion pigments with other ingredients to produce color required. Do not exceed pigment-to-cement ratio of 1 to 10, by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Where unit paving is to be installed over waterproofing, examine waterproofing installation, with waterproofing Installer present, for protection from paving operations, including areas where waterproofing system is turned up or flashed against vertical surfaces.

C. Proceed with installation only after unsatisfactory conditions have been

corrected.

3.2 PREPARATION

A. Remove substances from concrete substrates that could impair mortar bond, including curing and sealing compounds, form oil, and laitance.

B. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.3 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

D. Joint Pattern: As indicated.

E. Tolerances:

1. Do not exceed 1/32-inch unit-to-unit offset from flush (lippage) or 1/8 inch in 10 feet from level, or indicated slope, for finished surface of paving.
2. Do not exceed 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

3.4 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Apply mortar-bed bond coat over surface of concrete subbase about 15 minutes before placing mortar bed. Do not exceed 1/16-inch thickness for bond coat. Limit area of bond coat to avoid its drying out before placing setting bed.

C. Apply mortar bed over bond coat; spread and screed mortar bed to uniform thickness at subgrade elevations required for accurate setting of pavers to finished grades indicated.

D. Mix and place only that amount of mortar bed that can be covered with pavers before initial set. Before placing pavers, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

E. Place pavers before initial set of cement occurs. Immediately before placing

pavers on mortar bed, apply uniform 1/16-inch- thick bond coat to mortar bed or to back of each paver with a flat trowel.

F. Tamp or beat pavers with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver in a single operation before initial set of mortar; do not return to areas already set or disturb pavers for purposes of realigning finished surfaces or adjusting joints.

G. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/8 inch.

H. Grouted Joints: Grout paver joints complying with ANSI A108.10.

I. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.
2. Clean pavers as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.
3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

J. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.5 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

1. Remove temporary protective coating as recommended by coating manufacturer and as acceptable to paver and grout manufacturers.
2. Do not allow protective coating to enter floor drains. Trap, collect, and remove coating material.

END OF SECTION 32 14 00

SECTION 32 14 43

PERMEABLE GEO BLOCK GRAVEL PAVING SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
1. Cellular gravel-retention paving units for vehicular applications.
2. Aggregate infill for cellular paving units.
3. Open-graded subbase aggregate.
4. Base aggregate, as specified by project-specific pavement design.
5. Aggregate infill and base materials.
6. Edge restraints and cellular-unit anchorage.
7. Geotextiles and other geosynthetics, where indicated.

B. Related Sections
1. Section 32 16 00: Curbs.
2. Section 32 11 16: Aggregate base.
3. Section 33 41 00: Drainage pipes.
4. Section 31 23 33: Earthworks/excavation/soil compaction.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)
1. AASHTO M-288 Geotextile Specification for Highway Applications

B. American Society of Civil Engineers (ASCE)
1. ASCE 68-18, where applicable to permeable pavement design principles.

C. American Society for Testing and Materials (ASTM)
1. C29 Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate.
2. C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
3. C136 Method for Sieve Analysis for Fine and Coarse Aggregate.
4. C140 Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
5. D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
6. C1319 Standard Specification for Concrete Grid Paving Units, only if concrete grid units are proposed; not applicable to polymeric cellular grids.
7. C979 Specification for Pigments for Integrally Colored Concrete.
8. D698 or D1557, Laboratory Compaction Characteristics of Soil, as selected by the Geotechnical Engineer.

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9. C136/C136M Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
10. D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
11. C29/C29M Standard Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate, where specified.

D. Interlocking Concrete Pavement Institute (ICPI)
1. Permeable pavement design guidance, where applicable to project objectives.
2. Permeable Design Pro software for hydrologic and structural design.
3. AASHTO M 288, Geosynthetics for Highway Applications, where geotextiles are specified.
4. Manufacturer’s current installation and maintenance instructions for the selected cellular gravel-retention system.

1.02 SUBMITTALS

A. In accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Paver manufacturer’s/installation subcontractor’s drawings and details: Indicate perimeter conditions, junction with other materials, expansion and control joints, installation and setting details. Indicate layout, pattern and relationship of paving joints to fixtures, and project formed details.

C. Minimum 3 lb (2 kg) samples of subbase, base and bedding aggregate materials.

D. Sieve analysis of aggregates for subbase, base and bedding materials per ASTM C136.

E. Project specific or producer/manufacturer source test results for void ratio and bulk density of the base and subbase aggregates.

F. Soils report indicating density test reports, classification, and infiltration rate measured on-site under compacted conditions, and suitability for the intended project.

G. Erosion and sediment control plan.

H. Permeable cellular gravel paving:
1. Cellular paving system manufacturer’s product data, installation instructions, and maintenance requirements.
2. Representative sample of cellular unit and proposed aggregate infill, when requested.
3. Accepted samples become the standard of acceptance for the work of this Section.
4. Test reports substantiating claimed vehicular load capacity, durability, and permeability. Identify test method and complete tested assembly.

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5. Manufacturers' material safety data sheets for the safe handling of the specified paving materials and other products specified herein.
6. Manufacturer's quality-control documentation for cellular units and compatible system components.

I. Paver Installation Subcontractor:
1. Demonstrate experience installing cellular gravel-retention paving for vehicular applications of comparable scope.
2. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.
3. Written Method Statement and Quality Control Plan that describes material staging and flow, paving direction and installation procedures, including representative reporting forms that ensure conformance to the project specifications.

1.03 QUALITY ASSURANCE

A. Paver Installation Subcontractor Qualifications:
1. Utilize an installer having successfully completed cellular gravel-retention paving installations similar in design, loading, material, and extent indicated.
2. Provide references for comparable vehicular cellular gravel paving projects.

B. Regulatory Requirements and Approvals: The paver system will be inspected and approved by the City of Bentonville. Proposed Storage volume called out in the plans will need to be certified to close out the project.

C. Review the manufacturer's quality control plan, gravel paver installation subcontractor's Method Statement and Quality Control Plan with a pre-construction meeting of representatives from the manufacturer, paver installation subcontractor, general contractor, engineer and/or owner's representative.

D. Mock-Ups:
1. Install a 10 ft x 10 ft (3 x 3 m) paver area.
2. Use this area to review cellular-unit installation, anchorage, aggregate infill, finished grade, surface stability, and workmanship.
3. This area will be used as the standard by which the work will be judged.
4. Subject to acceptance by owner, mock-up may be retained as part of finished work.
5. If mock-up is not retained, remove and properly dispose of mock-up.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 1 Product Requirement Section.

B. Comply with manufacturer's ordering instructions and lead-time requirements to

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avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged container packaging with identification tags intact on each paver bundle.
   1. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.
   2. Deliver cellular units and accessories in manufacturer's packaging; protect against distortion and damage.
   3. Unload pavers at job site in such a manner that no damage occurs to the product or existing construction

D. Storage and Protection: Store materials in protected area such that they are kept free from mud, dirt, and other foreign materials.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not install in rain or snow.

B. Do not install frozen bedding materials.

1.06 MAINTENANCE

A. Extra materials: Provide 10% additional material for use by owner for maintenance and repair.

B. Pavers shall be from the same production run as installed materials.

PART 2 PRODUCTS

2.01 NOT USED

2.02 PRODUCTS AND SUBSTITUTIONS

A. Substitutions: Other gradations than those specified for crushed stone jointing material, base and subbase materials shall be approved in writing by the project engineer.

CRUSHED STONE FILLER, BEDDING, BASE AND SUBBASE

A. Cellular paving units: Commercially manufactured cellular gravel-retention units specifically intended for vehicular paving. Provide compatible connectors and anchors. Product selection shall be based on the project's design vehicle, traffic frequency, subgrade, and pavement section.

B. Aggregate infill: Clean, durable, angular or subangular aggregate compatible with cell geometry and design loading. Gradation shall be specified by the project-specific

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design and approved for the selected system. Do not use rounded river gravel unless specifically approved by the Engineer.

C. Aggregate cleanliness: Aggregate shall be free of soil, organic matter, and debris. Where the original company-standard aggregate cleanliness requirement is applicable to the specified aggregate layer, retain the requirement of less than 2 percent passing the No. 200 sieve.

D. Base and subbase materials shall have a minimum 0.32 porosity per ASTM C29.

E. E. Joint/opening filler, bedding, base and subbase: conforming to ASTM D448 gradation as shown in Tables 1, 2 and 3 below.

Table 1
ASTM No. 8 Grading Requirements
Bedding and Joint/Opening Filler

Sieve Size	Percent Passing
12.5 mm (1/2 in.)	100
9.5 mm (3/8 in.)	85 to 100
4.75 mm (No. 4)	10 to 30
2.36 mm (No. 8)	0 to 10
1.16 mm (No. 16)	0 to 5

Table 2
ASTM No. 57 Base
Grading Requirements

Sieve Size	Percent Passing
37.5 mm (1 1/2 in.)	100
25 mm (1 in.)	95 to 100
12.5 mm (1/2 in.)	25 to 60
4.75 mm (No. 4)	0 to 10
2.36 mm (No. 8)	0 to 5

Table 3
Grading Requirement for ASTM No. 2 Subbase

Sieve Size	Percent Passing
75 mm (3 in.)	100
63 mm (2 1/2 in.)	90 to 100
50 mm (2 in.)	35 to 70
37.5 mm (1 1/2 in.)	0 to 15
19 mm (3/4 in.)	0 to 5

PART 3 EXECUTION

3.01 NOT USED.

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3.02 EXAMINATION

A. Acceptance of Site Verification of Conditions:
1. General Contractor shall inspect, accept, and certify in writing that site conditions meet the requirements for cellular gravel paving before installation.
   a. Verify that subgrade preparation, compacted density, and elevations conform to the project-specific pavement design.
   b. Provide written density test results for soil subgrade to the Owner, General Contractor and paver installation subcontractor.
   c. Verify location, type, and elevations of edge restraints, [concrete collars around] utility structures, and drainage pipes and inlets.
2. Do not proceed until unacceptable subgrade conditions are corrected.

3.03 PREPARATION

A. Verify that the soil subgrade is free from standing water.

B. Stockpile infill, base, and subbase materials so they remain clean, uniformly graded, and free of organic material, sediment, and debris.

C. Edge Restraint Preparation:
1. Install edge restraints and cellular-system anchors in accordance with the Drawings and approved manufacturer's instructions.

3.04 INSTALLATION

A. General
1. Remove any temporary soil layer placed to trap sediment before installing geosynthetics and subbase.
2. Keep the pavement area free from sediment. Geosynthetics and aggregate contaminated with sediment shall be removed and replaced.
3. Do not damage drainpipes, overflow pipes, observation wells, or any inlets and other drainage appurtenances during installation. Report any damage immediately to the project engineer.

B. Geotextiles
1. Place geosynthetics only where indicated by the project design. Install and overlap in accordance with the applicable AASHTO M 288 requirements and manufacturer's instructions.
2. Provide overlaps and seams as indicated in the manufacturer's instructions.

C. Open-graded subbase and base
1. Moisten, spread and compact the No. 2 subbase in maximum 8 in. (200 mm) lifts Do not place subbase aggregate on a subgrade with water ponded on it. Do not damage underdrain pipes.

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2. For each lift, make at least two passes in the vibratory mode then at least two in the static mode with a minimum 10 t (8 T) vibratory roller until there is no visible movement of the No. 2 stone. Do not crush aggregate with the roller
3. Use a minimum 13,500 lbf (60 kN) plate compactor with a compaction indicator to compact areas that cannot be reached by the vibratory roller. Do not crush the aggregate with the plate compactor.
4. The surface tolerance of the compacted No. 2 subbase shall be ±2½ in. (±65 mm) over a 10 ft (3 m) straightedge, as stated in the company standard.
5. Place and compact the project-specified base aggregate in lifts and to the thickness shown in the project-specific pavement design.
   Place and compact base aggregate in accordance with the project-specific pavement design and approved aggregate supplier/manufacturer recommendations.
6. Base surface tolerance shall be as indicated in the project-specific pavement design.
   (25 mm) over a 10 ft (3 m) straightedge.
7. Light Weight Deflectometer (LWD) for Compacted Subbase and Base Aggregate Deflection Testing
   a. After three preloading drops, the maximum average deflection from three additional drops shall be no greater than 0.5 mm.
   b. Conduct LWD tests on every [800 tons (725 T)] of remaining area of compacted subbase and base aggregates.
8. Test Report
   a. The test report shall include the following:
      1) Project description.
      2) Sketch of test area and numbered test locations.
      3) Aggregate type and layer thicknesses.
      4) Aggregate characteristic properties: gradation, porosity, bulk density.
      5) Compaction equipment type and weight.
      6) Static and/or vibratory compaction.
      7) Number of passes of the compaction equipment.
      8) Average of three deflections for each location.

D. Bedding layer
1. Moisten, spread and screed the No. 8 stone bedding material. Maintain a consistent 2 in. (50 mm thickness prior to compaction with the pavers.
2. Fill voids left by removed screed rails with No. 8 stone.
3. The surface tolerance of the screeded No. 8 bedding layer shall be ±3/8 in (10 mm) over a 10 ft (3 m) straightedge.
4. Do not subject screeded bedding material to any pedestrian or vehicular traffic before paving unit installation begins.

E. CELLULAR GRAVEL PAVING INSTALLATION
1. Install cellular units over the prepared base in accordance with the approved manufacturer’s instructions. Maintain alignment and required transitions.

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2. Connect adjoining units and install anchors at the spacing and locations shown or required by the approved design.
3. Fill cells uniformly with approved aggregate infill. Avoid displacement or distortion of cellular units
4. Seat or compact infill only as recommended by the manufacturer and specified by the project design. Top up cells to the specified finished level.

3.05 FIELD QUALITY CONTROL

A. Inspect completed paving for conformance to line, grade, cross slope, infill level, edge restraint, and drainage requirements shown on the Drawings.

B. Verify that cellular units remain anchored and infill is stable and uniformly distributed. Correct displaced units, ruts, and low areas.

C. Verify finished elevations at drainage structures and transitions. Maintain positive drainage and keep inlets and channels unobstructed.

D. Bond lines for paver courses must meet manufacturer’s recommendations.

E. Where infiltration performance is specified, test the completed assembly using the project-specified method and acceptance criteria. ASTM C1781 is intended for permeable unit pavement systems and shall not be assumed applicable to every cellular gravel system without confirming suitability.

3.06 PROTECTION

A. After completion, protect paving from sediment deposition, contamination, and damage from subsequent construction.
B. PICP installation contractor shall return to site after 6 months from the completion of the work and provide the following as required: fill paver joints with stones, replace broken or cracked pavers, and re-level settled pavers to initial elevations. Any additional work shall be considered part of original bid price and with no additional compensation.

END OF SECTION

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SECTION 32 16 00

WALKS & CURBS

PART 1 GENERAL

1.1 SCOPE:

A. Provide all materials, labor, equipment and related items necessary to complete the concrete walks and curbs as shown on the drawings.

1.2 RELATED SECTIONS

A. Section 32 11 16: Crushed Stone Base Course.

B. Section 32 12 16: Asphalt Paving

C. Section 03 11 00: Concrete Form Work

D. Section 03 21 00: Concrete Reinforcement

E. Section 03 30 00: Cast-in-Place Concrete

F. Section 07 92 00: Sealants

1.3 PUBLIC WORKS

A. Comply with the City of Bentonville's standard specifications for Public Street Construction. If conflict should be found between this section and the City Standards for Public Street Construction, City Standards shall be the priority.

PART 2 PRODUCTS/ /MATERIALS

2.1 WALKS & CURBS:

A. 3,000 psi at 28 days in accordance with ACI and CRSI Standards, 3,500 for curbs. Materials, testing, and placing shall be specified in Division 3. Concrete to be air entrained per Section 03 30 00. No fly ash is permitted in walks or curbs.

2.2 EXPANSION JOINTS

A. Expansion joint material shall be 1/2" pre-molded filler especially made for such use - not INSULATION or SHEATHING BOARD for all curbs and non-exposed aggregate walks and pavement.

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PART 3 EXECUTION

3.1 CONCRETE WALKS

A. Concrete walks shall be of one course construction 5 inches thick, and of widths shown on the drawings. Provide 1/8" per foot crown or cross slope in the direction of drainage. All steps are to drain freely. Provide tooled joints as shown on drawings.

B. Expansion joints: Provide 1/2" transverse expansion joints, at walk junctions and intersections, at top and bottom of steps, and where walks abut curb returns, buildings, platforms or other fixed structures, or terminate at curbs. Expansion joints shall be at right angles to the slab and extend the full depth thereof. Pre-molded filler where called for shall extend to within 1/2" of the surface. Fill remaining void with sealant as specified in Section 07 92 00. Locate expansion joints in walks as shown on plans and nearly as practicable opposite those in abutting curbs, approximately 20' on center.

C. Control Joints: Provide troweled joints 1/4 of slab depth where indicated on plans.

D. Protection. Remove no forms for 24 hours after pouring concrete. Protect concrete walks and courtyards from pedestrian traffic for a period of three days after pouring.

3.2 WALKS AND CURB FINISH

A. Finish Types shall be the following:
   1. Light Broom Finish

B. Light Broom Finish:
   1. After placing concrete paving, do not work the surface further until ready for floating.
   2. Begin floating when the surface water has disappeared and when the concrete has stiffened sufficiently to permit operation of a power- driven float, or both.
   3. Consolidate the surface with power-driven floats, or by hand-floating if the area is small or inaccessible to power units.
   4. Check and level the surface plane to a tolerance not exceeding 6mm in 3 m (1/4" in 10'-0") when tested with a 3 m (10'-0") straightedge placed on the surface at not less than two different angles.
   5. Cut down high spots and fill low spots.
   6. Uniformly slope surfaces to drains where required.
   7. Immediately after leveling, re-float the surface to a uniform, smooth, granular texture as approved by the Architect.
   8. At this point, apply a light broom finish in one direction. Make sweeps uniform and continuous, keeping bristles clean after each sweep. Provide a small sample area for approval by Architect prior to finishing entire surface.

3.3 CONCRETE CURBS

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A. All machine poured curbs to be shape and profile shown on Drawings.

B. Construct hand formed concrete curbs in small workable sections. Size and depth of curbs shall be generally 6" wide x 18" deep with sloped face, unless noted otherwise on Drawings.

C. Provide 1/2 inch expansion joints, with pre-molded filler cut to shape of cross section at ends of all returns at 40 foot intervals, maximum. Align with sidewalk expansion joints where curb abuts sidewalk. Fill top 1/2" of joint with sealant as specified in section 07 92 00. Provide sawn control joints at 20' o.c., max. Fill with sealant.

D. Tamp and screed concrete as soon as placed. Remove division plates and face forms as soon as practicable; fill any honeycombed places with 1:2 mortar and give exposed surfaces same finish as specified for concrete walks.

E. Remove no forms, except face forms, for 24 hours after placing concrete. Protect against pedestrian traffic for three (3) days and against vehicular traffic for 14 days. Compact thoroughly and backfill behind curb. Place and compact fill behind curb as soon as practical.

3.4 CURB CUTS

A. At streets, where indicated on Drawings, construct curbs to conform to shape and dimension as shown on the Drawings.

B. Contractor is responsible for obtaining permit to cut curbs on highways and paying any fees associated with the same.

END OF SECTION

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SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. General painted pavement markings.

B. Fire Lane Marking

C. Handicapped symbol painting.

1.2 RELATED SECTIONS

A. Construction Drawings

B. Section 32 12 16 - Asphaltic Paving

1.3 PROJECT CONDITIONS

A. Maintain access for vehicular and pedestrian traffic as required for other construction activities. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 PRODUCTS

2.1 MATERIALS

A. Paint Type: Federal Highway Administration approved. Paint shall be Promar alkyd traffic marking paint, manufactured by Sherwin Williams, factory mixed, quick-drying, non-bleeding, or approved equal.

B. The following items are to be painted with the colors noted below:

Letters, Arrows & Lane Striping:	White
Handicap Symbols:	Blue & White (Refer to detail on drawings)
Guard posts/Bollards:	Color as selected.
Parking Stall Striping:	White
Curb @ Fire lane:	Red with 3" high white block letters "No Parking Fire Lane" every 30 feet of curb. Paint entire curb, or if there is no curb, paint 4” wide stripe with 3” high letters on edge of pavement.

PART 3 EXECUTION

3.1 PREPARATION

A. Sweep and clean surface to eliminate loose material and dust.

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3.2 APPLICATION

A. Apply two (2) coats of paint at manufacturer's recommended rate with total maximum of 320 lineal feet per gallon per coat with 4" wide stripe. Apply with mechanical equipment to produce uniform straight edges. At sidewalk curbs, use a straightedge to ensure a uniform, clean, and straight stripe.

B. Do not apply pavement marking paint until layout, colors and placement have been verified with Architect. Allow paving to age for minimum 20 days prior to pavement markings. Sweep and clean surfaces to eliminate loose materials and dust.

C. Pavement markings to be applied in suitable weather conditions.

END OF SECTION

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SECTION 32 31 19 DECORATIVE METAL FENCES AND GATES

PART 1 - 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. Decorative metal fences.
   2. Swing gates.
   3. Expanded mesh fences.
   4. Fence and gate assemblies at boardwalks, including special connections to boardwalk structure.
   5. Posts, frames, infill, hardware, anchors, finishes, and accessories required for complete installations.

B. Related Requirements:
   1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for concrete.
   2. Section 32 34 13 for boardwalk structure and manufacturer-supplied fence and gate connection brackets.
   3. Division 26 Sections for electrical work, if any.

C. Coordinate dimensions, locations, grades, and interfaces with Drawings and adjacent construction before fabrication.

1.3 REFERENCES

American Architectural Manufacturers Association (AAMA):
1. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.

B. ASTM International (ASTM):
   1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   2. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   3. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes.
   4. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

5. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated by the Hot-Dip Process.
6. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
7. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
8. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
9. ASTM C1107/C1107M - Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

C. American Welding Society (AWS):
1. AWS D1.1/D1.1M - Structural Welding Code - Steel.
2. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel, where applicable.

D. Builders Hardware Manufacturers Association (BHMA):
1. BHMA A156.1 - Butts and Hinges.

E. National Ornamental & Miscellaneous Metals Association (NOMMA):
NOMMA Guidelines for ornamental and miscellaneous metals workmanship and weld finishing.

F. Society for Protective Coatings (SSPC):
1. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Landscape Architect, Contractor, fence and gate installer, fabricator, boardwalk manufacturer or representative where applicable, and trades involved in adjacent work.
1. Review approved Shop Drawings, dimensions, grades, post locations, foundations, finishes, gate operation, hardware, boardwalk connections, and protection of adjacent construction.
2. Review field verification requirements before fabrication.
3. Review procedures for repair of damaged coatings and field welds or cuts.
4. Review mockup requirements and acceptance criteria.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Manufacturer's data sheets on each product to be used.
2. Preparation instructions and recommendations.
3. Storage and handling requirements and recommendations.
4. Typical installation methods.
5. Finish system data, including primer, topcoat, powder-coat system, or other specified coating.

B. Shop Drawings: For fencing and gates.

1. Plans, elevations, sections, details, dimensions, post spacing, gate locations, opening dimensions, infill spacing, and attachment details.
2. Identify materials, member sizes, wall thicknesses, welds, fasteners, anchors, hardware, coatings, and finishes.
3. Show transitions, corners, changes in grade, terminations, returns, and interfaces with paving, walls, structures, and planting.
4. Show gate swing, clear opening, latch locations, cane bolts, hinges, keepers, strikes, and padlock provisions.
5. Show connection of gate and fence to boardwalk structure via bracket supplied by boardwalk manufacturer. Coordinate with Section 32 34 13.
6. Submit coordinated Shop Drawings to Landscape Architect for review prior to fabrication.

C. Samples: For all fence and gate materials and for each color specified.
1. Provide Samples 12 inches in length for linear materials.
2. Provide finish samples large enough to demonstrate color, texture, sheen, and coating uniformity.

D. Hardware Schedule: Identify manufacturer, type, material, finish, quantity, and location of each gate hardware item.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and installer.

B. Welding qualifications and procedures when requested.

C. Field quality-control reports.

D. Manufacturer's installation instructions.

E. Finish manufacturer's written requirements for field touch-up and repair.

F. Delivery documentation identifying coating system and batch or lot information when requested.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: According to manufacturer's recommendations.

B. Record documentation identifying final gate hardware, finish systems, and special maintenance requirements.

C. Warranty documentation.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with a minimum five years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this Section with minimum two years documented experience with projects of similar scope and complexity.

C. Fabricator Qualifications: Experienced in ornamental and miscellaneous metal fabrication of comparable scale and complexity.

D. Welding: Perform welding by qualified welders using procedures appropriate for the materials being joined.

E. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

F. Mockups: Construct a mock-up with actual materials in sufficient time for Landscape Architect's review and to not delay construction progress. Locate mock-up as acceptable to Landscape Architect and provide temporary foundations and support.

1. Include 10-foot length of fence complying with requirements.
2. Include representative post, rail, picket, connection, finish, and termination conditions.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
4. Intent of mock-up is to demonstrate quality of workmanship, alignment, fabrication, finish, and visual appearance.
5. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
6. Retain mock-up during construction as a standard for comparison with completed work.
7. Do not alter or remove mock-up until work is completed or removal is authorized.

1.9 DELIVERY, STORAGE AND HANDLING

A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.

B. Protect finished surfaces from scratches, abrasion, staining, distortion, corrosion, and other damage.

C. Store components off the ground on padded supports, separated to permit air circulation and prevent contact with incompatible materials.

D. Do not use chains, cables, or handling devices that can damage exposed finished surfaces.

E. Replace components that are bent, twisted, cracked, gouged, corroded, or otherwise damaged beyond acceptable field repair.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not apply coatings under environmental conditions outside manufacturer's recommended limits.

B. Verify field dimensions and existing grades before fabrication. Do not fabricate from scaled Drawings alone.

C. Coordinate work with underground utilities, irrigation, drainage, foundations, paving, planting, boardwalks, and adjacent structures.

D. Do not install fence or gate components until substrates and supporting construction are sufficiently complete to receive the Work.

1.11 WARRANTY

A. Manufacturer's standard limited warranty unless indicated otherwise.

B. Correct defective Work, including coating failure, corrosion attributable to defective materials or workmanship, failed welds, and defective gate hardware, within the warranty period at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 DECORATIVE METAL FENCES

A. Decorative Steel Fences: Fences made from wrought iron tubes, bars, and shapes, as shown on Drawings.

B. Fencing and Gates:
1. Size: As indicated on Drawings.
2. Material: Wrought Iron.
3. Color: Black.
4. Style: Heritage Ornamental Fence, Product ID H2L-48.
5. Columns: Decorative, refer to Drawings.
6. Vendor: Tuscumbia IronWorks, or approved equal. info@tuscumbiaironworks.com.

C. Fasteners: Wrought iron carriage bolts and nuts unless otherwise indicated.

D. Fabrication: Assemble fences into sections by welding pickets to rails.
1. Fabricate sections with clips welded to rails for field fastening to posts.
2. Drill posts and clips for fasteners before finishing to maximum extent possible.
3. Fabricate accurately to required dimensions and free from warp, twist, bow, or other distortion.
4. Make exposed joints neat and inconspicuous.

E. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.

F. Finish for Wrought Iron Items: DTM Acrylic Enamel: Black or approved equal.

G. Field touch-up and repair materials shall be compatible with the original finish system and supplied or approved by the finish manufacturer.

2.2 SWING GATES

A. Gate Configuration: Single leaf unless indicated otherwise.

B. Gate Frame Height: As indicated on Drawings.

C. Gate Opening Width: As indicated on Drawings.

D. Wrought Iron Frames and Bracing: Fabricate members from square stainless steel according to dimensions on Drawings. Coordinate material and finish compatibility before fabrication.

E. Frame Corner Construction: Welded.

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill: Comply with requirements for adjacent fence.

H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

I. Hardware: Latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf. Provide cane bolts as shown on Drawings. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

J. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.
1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Stainless steel.

K. Cane Bolts: Provide as shown on Drawings. Fabricated from 3/4-inch diameter, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions.

L. Finish exposed welds to comply with NOMMA Guideline 1, Finish #4 - good-quality, uniform undressed weld with minimal splatter.

M. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

N. Finish: DTM Acrylic Enamel: Black or approved equal.

O. Gate frames shall be rigid and sufficiently reinforced to maintain alignment and smooth operation under normal use.

2.3 EXPANDED MESH FENCES

A. Product: Jacob Webnet with sleeves or approved equal.

B. Vendor: Jakob Rope Systems, 119 H St, Lake Worth, FL, 33460.

C. Color: Silver, woven stainless steel.

D. Fasteners: Provided by vendor.

E. Posts and Frame: 2 in by 2 in square steel tube, powder coated dark bronze, 61/68001.

F. Install mesh taut, uniform, and free from kinks, wrinkles, visible deformation, or irregular tension.

2.4 FENCE AT BOARDWALK

A. Frame: 3-inch by 3-inch square steel tube, welded, hot-dip galvanized.

B. Upper Infill: Stainless steel wire rope cables, 3/16-inch diameter, 3 inches o.c. maximum. Height: 3'-0".

C. Lower Infill (Skirt): Stainless steel cable mesh, 3/16-inch diameter, galvanized, height varies to match grade, 2'-6" maximum.

D. Base: Secure base of mesh to grade with galvanized ground anchors at 6'-0" o.c.

E. Finish: Powder coated, dark bronze, 61/68001.

F. Connection: Fence to connect to boardwalk structure via bracket supplied by boardwalk manufacturer (Section 32 34 13).

G. Coordinate connection locations, fastener types, tolerances, and structural requirements with boardwalk manufacturer before fabrication.

H. Do not field-drill or weld to the boardwalk structure unless specifically approved by the boardwalk manufacturer and Landscape Architect.

2.5 GATE AT BOARDWALK

A. Configuration: Double gate, 6'-3 1/2" per leaf.

B. Frame: 4-inch by 4-inch square steel tube, welded, hot-dip galvanized.

C. Infill: Stainless steel wire rope cables, 3/16-inch diameter, 3 inches o.c. maximum. Height: 6'-0".

D. Hinges: (3) heavy-duty, 304 stainless steel, by McMaster-Carr or approved equal.

E. Hardware: Latch with cane bolt and strike plate, by McMaster-Carr or approved equal.

F. Finish: Powder coated, dark bronze, 61/68001.

G. Connection: Gate to connect to boardwalk structure via bracket supplied by boardwalk manufacturer (Section 32 34 13).

H. Gate leaves shall be fabricated square and rigid, with clearances coordinated for full swing and latch engagement.

I. Coordinate gate swing with adjacent boardwalk, railings, planting, grades, and accessible circulation.

2.6 STEEL AND IRON

A. All elements: Stainless Steel Type 316 or approved equal, where stainless steel is indicated.

B. Dissimilar metals: Provide compatible materials, isolators, coatings, or other measures necessary to prevent galvanic corrosion at interfaces.

2.7 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

D. Anchors and Fasteners: Corrosion-resistant and compatible with materials being joined. Provide stainless steel where exposed or where indicated.

E. Isolation Materials: Nonconductive washers, sleeves, gaskets, or coatings where required to separate dissimilar metals.

2.8 STEEL FINISHES

A. Surface Preparation: Clean surfaces according SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Blackened Steel: Alloy based. Additional information TBD.

C. Powder Coating: Where indicated, provide a complete powder-coat system suitable for exterior exposure, including pretreatment, primer where required, and topcoat. Color and gloss shall match approved samples.

D. Finish coatings shall be continuous, uniform, and free of runs, sags, pinholes, holidays, blisters, peeling, overspray, and visible substrate defects.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Verify dimensions, grades, post locations, gate openings, structural supports, and connection points before fabrication.

C. Do not begin installation before final grading is completed unless otherwise permitted by Landscape Architect. If substrate preparation is the responsibility of another installer, notify Landscape Architect in writing of unsatisfactory preparation before proceeding.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Consult with local jurisdictional authorities regarding specific utility locations. Arrange for a local underground utility locating service to identify and locate potential below-grade utility hazards such as electric, gas, water, sewer, telecommunications and similar infrastructure prior to commencing clearing, digging, excavating or fence installation.

B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 20 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

C. Verify final fence and gate elevations against adjacent grades and construction. Obtain Landscape Architect's approval before making adjustments that materially alter the Drawings.

D. Protect existing paving, planting, structures, boardwalk components, and other adjacent work during excavation and installation.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction. Install fences by setting posts as indicated and fastening rails to posts.

B. Posts: Locate and space according to Manufacturer drawings. Set posts in suitable concrete footers designed and constructed for structural integrity in specific application. Consult Marine engineer drawings.

1. Setting of posts by other methods is permissible only as determined by Landscape Architect or engineer.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet, unless greater dimensions are indicated by structural requirements or Drawings.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
   a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.
3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Space posts uniformly at dimensions shown on Drawings.

E. Install fence panels level, plumb, true to line, and with consistent spacing and alignment. Match approved mockup.

F. Make field connections tight and secure. Do not force components into alignment in a manner that induces visible distortion.

G. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

H. Install boardwalk fence and gate connections using brackets and methods approved by boardwalk manufacturer. Do not compromise waterproofing, structural members, or protective coatings.

I. Maintain required clearances and avoid contact with adjacent paving, walls, planting, drainage structures, and other construction except where specifically detailed.

3.3 FIELD MODIFICATIONS AND FINISH REPAIR

A. Fence installation may require limited cutting or drilling to accommodate slight variations in field measurements and normal construction tolerances. Contractor shall take reasonable precautions to make sure exposed metal surfaces are properly sealed from environment, as described below.

1. Failure to properly clean, prime and finish paint exposed surfaces as described in the following steps will void the Manufacturer's Warranty.
2. Carefully inspect fence and metal components during installation.
3. Remove metal shavings from drilling or cutting of posts or metal fence components.
4. Where drilling or cutting was deemed necessary, clean metal surfaces and apply two (2) coats of zinc-rich metal primer to thoroughly cover each cut edge or hole drilled during installation processes. Allow each coat to dry thoroughly.
5. Apply two (2) thin coats of Manufacturer-supplied custom touch-up paint to such locations. Allow each coat to dry thoroughly.
6. Inspect work and verify each drilled or cut metal surface was properly treated, as described above.

B. Repair damaged galvanized coatings in accordance with ASTM A780/A780M and coating manufacturer's written instructions.

C. Repair damaged powder-coated or painted finishes using materials and methods approved by finish manufacturer. Blend repairs to produce uniform appearance.

D. Do not field-weld finished components unless specifically approved. Protect adjacent finished surfaces from welding heat, sparks, and splatter.

3.4 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

C. Adjust gate clearances and stops so that leaves do not strike adjacent construction and remain securely latched.

D. Verify cane bolts engage fully in strikes in both open and closed positions where applicable.

3.5 FIELD QUALITY CONTROL

A. Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

1. Inspect installation, post spacing, location dimensions, alignment, gate operation, connections, and finishes.
2. Verify concrete footings are adequately consolidated and that posts remain plumb and aligned after concrete has cured.

3. Verify all exposed cuts, drilled holes, field welds, and coating repairs have been properly treated.
4. Document preparatory, initial and follow-up inspection in Contractor's Test and Inspection Reports.
5. Contractor Test and Inspection Reports shall be available to Landscape Architect and Manufacturer upon request.

B. Remove and replace components that cannot be corrected to meet requirements.

C. Correct deviations from approved Shop Drawings and mockup at no additional cost to Owner.

3.7 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

B. Demonstrate operation of all latches, cane bolts, hinges, keepers, and other moving hardware.

C. Provide manufacturer's recommended maintenance procedures and compatible touch-up materials.

3.8 CLEANING AND PROTECTION

A. Clean products in accordance with the manufacturers recommendations.

B. Remove dirt, dust, construction debris, labels, protective films, metal shavings, weld residue, and other contaminants from completed work.

C. Do not use cleaning agents or tools that damage coatings, galvanizing, stainless steel, or adjacent materials.

D. Touch-up, repair or replace damaged products before Substantial Completion.

E. Protect completed fence and gate work from damage by subsequent construction operations until Substantial Completion.

F. At Substantial Completion, inspect all fence and gate components and leave the Work clean, fully operable, and free of visible defects.

END OF SECTION 32 31 19

SECTION 32 32 19 GARDEN WALL

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: Supply and installation of structural garden wall, with brick units and limestone cap. Work of this Section includes all labor, materials, equipment and services necessary to complete the work as shown on the drawings and/or specified herein, including but not necessarily limited to the following:
   1. Concrete block walls.
   2. Joint sealant walls.
   3. Metal joint reinforcing, anchors, ties, closures and related accessories for masonry.
   4. Control and expansion joints in masonry, filled with joint fillers.
   5. Chases, recesses, pockets and openings in masonry as required for installation of work by others.
   6. Building in of items furnished by others into masonry, including access doors, door frames, anchors, sleeves and inserts, and other similar items to be embedded in masonry.
   7. Grouting in of metal items built into masonry work.
   8. Protection, pointing and cleaning of masonry.
   9. Coordination of masonry work with fountain work, utilities, drainage, planting and adjacent site construction.

B. Related Sections May include:
   1. Related Sections: Unit Masonry 04 20 00.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this Section with other related work, including structural work, fountain work, paving, site furnishings, utilities, drainage, planting, waterproofing and work embedded in or adjacent to masonry.

B. Schedule: Prepare a schedule for the work of this Section including a detailed activity list, start and finish dates, milestones and date of substantial completion. Provide Landscape Architect with a copy of proposed schedule and obtain Landscape Architect’s acceptance of schedule.

C. Pre-Installation Meeting: Convene a pre-installation site meeting at least 7 days prior to commencing work at site. Require attendance of parties directly affecting work of this Section, including Landscape Architect and, if appointed, testing agency. Review work activities and schedule. Tour site and inspect and discuss site physical conditions. Review

required inspections, mockup requirements, material deliveries, protection, weather limitations and coordination with adjacent work.

1.4 SUBMITTALS

A. Provide Landscape Architect with submittals specified in this clause at least 30 days prior to scheduled commencement of work at site.

B. Shop Drawings: Submit shop drawings for the following:
   1. Anchoring details.
   2. Control and expansion joint locations and details.
   3. Layout and dimensions.
   4. Wall sections, coursing, bond patterns, returns, corners, openings and transitions.
   5. Locations of reinforcing, grouting, embedded items, sleeves, anchors and ties.
   6. Limestone cap profiles, joints, corners, radial conditions and transitions.
   7. Coordination details at fountain work and other adjacent construction.

C. Submit Samples for the following:
   1. Joint reinforcing, each type, width and proposed location (labeled).
   2. Anchors, wedges and ties, each type, width and proposed location (labeled).
   3. Joint filler, each type.
   4. Limestone cap showing the front ledge profiles – 4 inches by 4 inches by 3 inches.
   5. Sample brick.

D. Submit technical and installation information for the following:
   1. Mortar materials, each material and mortar type.
   2. Certification of mortar mix.
   3. Flashing material, descriptive literature.
   4. Concrete block, joint reinforcing, anchors, ties and joint filler; submit manufacturer's technical and descriptive literature.
   5. Block manufacturer certifications of compliance with ASTM C 90, ASTM C 331 and UL 618 prior to any job site delivery. Field sampling of concrete block may be tested by an Independent Testing Laboratory.

E. Construction Procedures: Submit the following:
   1. Procedures and materials for cleaning masonry work, including certification that cleaner will not adversely affect stone, gaskets, sealants, adjacent materials or finishes.
   2. Procedures for protection of completed masonry during construction.
   3. Procedures for cold-weather and hot-weather masonry construction.

F. Product Data: Submit manufacturer’s product data for each type of product to be used. For soils and aggregates provide testing agency laboratory analysis.

G. Qualification Data: Submit proof of qualifications of installer and installer’s site supervisor.

H. Mockup: Submit proposed mockup materials, mortar, brick, limestone cap, joint profiles and cleaning procedures prior to construction of the required mockup.

1.5 MOCK UP

A. Provide a 8’-0” x 8’-0” mock up wall section showing the brick archway and limestone cap. Upon satisfactory completion of the mock up and approval by the Landscape Architect, the mock up may remain in place for final construction.

B. Mockup shall demonstrate representative brick coursing, mortar joints, control or expansion joint conditions, limestone cap profile, corners, archway, finish quality and cleaning.

C. Do not proceed with exposed final masonry construction until mockup has been reviewed and approved by Landscape Architect.

D. Approved mockup shall establish the standard for workmanship, appearance, joint tooling, color, texture, alignment and cleaning of the completed Work.

1.6 QUALITY ASSURANCE

A. Conform to the following non-cumulative tolerances. Any masonry work not meeting these standards shall be re-built as directed by the Landscape Architect:
   1. Variation from Plumb: in lines and surfaces of walls 1/8” in 10 feet.
   2. Variation from level or grades dictated in drawings: 1/4” in 20 feet.
   3. Variation of the linear building lines from established position in plan: 1/2” in 40 feet.
   4. Variation in cross sectional dimensions and thickness of walls: +/- 1/8”.
   5. Variation in dimensions of masonry openings: Horizontal and Vertical +/- 1/16”.

B. Work of this Section shall conform to the requirements of the following, unless otherwise superseded by prevailing Building Code:
   1. 2008 ACI 530/ASCE 5/TMS 402 Building Code Requirements for Masonry Structures. 2008 ACI 530-1/ASCE 6/TMS 602 Specifications for Masonry Structures.

C. Install masonry by an experienced masonry contractor regularly engaged in work of similar type, material and scale.

D. Provide a competent site supervisor familiar with masonry construction, mortar mixing, reinforcement, anchorage, jointing, cleaning and protection.

E. Field Quality Control: Where testing is required by the Contract Documents or directed by Landscape Architect, provide access for Independent Testing Laboratory to sample and test materials and completed work.

1.7 PRODUCT HANDLING

A. General: Deliver, store, handle and protect all materials from damage, moisture, dirt and intrusion of foreign matter. Store all masonry units and mortar materials on raised platforms and under ventilated and waterproof cover. Store packaged materials in manufacturer's unopened containers, marked with manufacturer's name and product brand name. Immediately reseal containers after partial use. Remove and replace damaged materials.

B. Masonry Units: Pack, deliver and store to prevent breakage, cracking, chipping, spalling or other damage. Store, protect and ventilate units at project site.

Aggregate: Store with provisions for good drainage.

C. Reinforcement and Anchors: Store and protect so that when placed, joint reinforcement and anchors will be free of soil, dirt, ice, loose rust, scale, or other coatings which would destroy or reduce bond with mortar, and will not be disfigured or bent out of shape.

D. Limestone: Protect from staining, chipping, cracking, scratching, weathering and contact with materials that could discolor or damage finished surfaces.

1.8 JOB CONDITIONS

A. In cold weather, when the outside temperature is below forty (40) degrees F., conform to the requirements of 'Cold Weather Masonry Construction and Protection Recommendations' publication by Brick Industry Association (BIA). No anti-freeze admixtures are permitted.
   1. In addition, conform to the following:
      a. Masonry materials must be warmed as required.
      b. Brickwork must be protected a minimum of 24 hours after installation so as to maintain enough heat for hydration of the cement in the mortar.

B. B. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg. F. and above.
   1. Masonry materials must be cool.
   2. Mortar must be used within 2 hours of initial mixing.

C. C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.

D. Do not construct masonry when conditions are unsuitable for proper bond, curing, alignment or protection. Protect completed work from weather and construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Standard Concrete Block.
   1. Portland cement, ASTM C 150, Type 1, low alkali (less than 65) one source.

B. Brick: Provide units without cores or frogs and with exposed surfaces finished for ends of walls and fascia.
   1. Face Brick.
   2. Vendor: Gavin Historical Bricks, 2050 Glendale Rd. Iowa City Iowa, USA, info@historicalbricks.com.
   3. Color: Antique Iowa Brick, or approved equal.

C. C. Limestone Cap: Provide limestone cap as per dimensions to drawings with eased edges and profiles matching the drawings.
   1. Color: Prairie Shell.
   2. Vendor: US Stone, 2561 Q Ave, Herington, KS 67449.
   3. Provide pieces of sufficient length and size to minimize joints and provide continuous appearance at straight and curved conditions.

D. Aggregates, ASTM C 331, lightweight expanded shale, clay or slate aggregates, manufactured by the rotary kiln process equal to 'Solite,' 'Norlite,' or 'Haydite.'
   1. Block scheduled to receive painted finish shall contain normal weight aggregate meeting ASTM C-33 in addition to light weight aggregate in order to receive a smooth, uniform finish.

E. Concrete Masonry Units: Load bearing lightweight aggregate concrete masonry units conforming to the requirements of ASTM C 90.
   1. Block behind veneer block and block for rated walls shall be 75% solid units.
   2. All other block may be hollow units.

F. Sizes and Shapes: Nominal face size by thickness as indicated on drawings, with stretcher units, jamb units, header units, square corner units (at ends and corners of exposed or painted work), sash units (at control joints within masonry wall), lintel units and other special shapes and sizes required to complete the work.

G. The producer of the concrete masonry units shall furnish certification from an independent testing laboratory confirming that all 8" or larger masonry units meet all of the UL 618 requirements for two (2) hours or better (as required), referencing full scale fire test reports (ASTM E 119). All 4" and 6" units shall conform to 'National Bureau of Standards' and 'National Research Council' full scale fire tests.

H. Finish: For exposed or painted block surfaces, in addition to ASTM requirements, block shall have uniformly dense, flat, fine grain texture, with no cracks, chips, spalls, or other defects which would impair appearance. For concealed CMU, surfaces shall be free from deleterious materials that would stain plaster or corrode metal.

I. Curing: All concrete block shall be steam cured, and air dried for not less than thirty (30) days before delivery.

J. Density of concrete block shall not exceed one hundred and five (105) lbs. per cubic foot.

K. Shrinkage: Shrinkage of concrete blocks shall not exceed 0.065% when tested in accordance with ASTM C 426-99.

L. Water Content:
   1. At the time of delivery to the job site, concrete masonry units shall have a value, in weight of contained water, of not more than thirty (30) percent of the fully saturated content for the unit tested.

2. Ship all units from the factory, and store at the job site, with all necessary protection to prevent increase of water content from rain and other source.

2.2 JOINT SEALANTS

A. Provide one (1) part non-sag sealant equal to No. 790 or 795 made by Dow Corning, 'Silpruf SCS 2000' or 'LM SCS 2700' made by G.E. or 'Spectrem 1' or 'Spectrem 3' made by Tremco or 'Sonolastic 150' by Sonneborn conforming to the minimum standards of ASTM C 920, Type S, Grade NS, Class 50.

B. Back-Up Materials: Provide back-up materials and preformed joint fillers, non-staining, non-absorbent, compatible with sealant and primer, and of a resilient nature, equal to 'HBR' made by Nomaco Inc. or approved equal, twenty-five (25) percent wider than joint width. Materials impregnated with oil, bitumen or similar materials shall not be used.

C. Sealant color shall be selected to closely match adjacent masonry unless otherwise indicated by Landscape Architect.

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type 1, standard color, one source.

B. Hydrated Lime: ASTM C 207, Type S, as manufactured by Corsons, or approved equal.

C. Aggregate: Clean, washed, buff colored sand, graded per ASTM C 144.

D. Aggregate for Grout: ASTM C 404.

E. Water: Clean, fresh and suitable for drinking.

F. Exterior masonry: Provide integral waterproofing additive in mortar.

G. Vertical Soil Inspection Pipe: 150 mm diameter rigid 100% high density polyethylene.

2.4 MORTAR MIX

A. Exterior Masonry Construction: Provide Portland cement/lime mortar conforming to ASTM C 270, Type M.

B. Mixing:
1. General: Add cement just before mixing and mix dry. Use sufficient amount of water as necessary to produce workable mix. Mix in small batches to make plastic mass.
2. Mixing: Machine mix all mortars in approved type mixer with device to accurately and uniformly control water. Add hydrated lime dry. Mix dry materials not less than two (2) minutes. Add water, then mix not less than three (3) minutes, not to exceed five (5) minutes. Mix only amount of mortar that can be used before initial set. Do not use mortar which has reached its initial set or two (2) hours after initial mixing, whichever comes earlier. Mortar may not be re-tempered. Clean mixer for each batch, whenever mortar type is changed, and at end of each day's work.
3. Acceleration or other admixtures not permitted.

4. Mortar shall have a flow after suction of not less than seventy-five (75) percent of that immediately after mixing as determined by ASTM C 91.

C. C. Admixtures:
1. No air-entraining admixtures or cementitious materials containing air-entraining admixtures shall be used in the mortar.
2. No antifreeze compounds or other substances shall be used in the mortar to lower the freezing point.
3. Calcium chloride or admixtures containing calcium chloride shall not be used in mortar.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates, foundations, adjacent construction, embedded items and conditions affecting installation. Notify Landscape Architect of conditions that would prevent proper execution.

B. Concrete Block: Do not wet concrete block.

C. Carefully coordinate with all other trades to ensure proper and adequate interface of the work of other trades with the work in this Section.

D. Verify locations of utilities, sleeves, piping, fountain work, drainage, reinforcement, anchors and other embedded items before beginning masonry construction.

E. Do not begin masonry construction until foundations and supporting construction are sufficiently complete and cured to support the Work.

3.2 INSTALLATION

A. GENERAL: Build walls to the full thickness shown. Build single wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown.

B. Build chases and recesses as shown or required for the work of other trades.

C. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.

D. Leave openings to account for the fountain work.

E. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement type joints, returns and off-sets. Avoid the use of less than half size units at corners, jambs and wherever possible.

F. Lay up walls plumb and true with courses level, accurately spaced and coordinated with other work.

Provide templates made of steel studs for plumbing of two story masonry openings.

G. Pattern Bond: Lay exposed masonry patterns as noted on drawings and to match Architecture. Lay concealed concrete block with all units in a wythe bonded by lapping not less than two (2) inches. Bond and interlock each course of each wythe at corners. Do not use units of less than four (4) inches horizontal face dimensions at corners or jambs.

H. Mortar, ties and reinforcement must not extend into or bridge any expansion joints.

I. Precast Concrete Cap: Install caps and cut end joints to accommodate radial curves.

J. Limestone Cap: Install caps to lines and grades shown, with uniform joints, consistent profiles and continuous alignment. Protect finished faces from mortar staining and damage.

K. Construct archway and other special masonry features in accordance with approved shop drawings and mockup. Maintain consistent coursing and joint dimensions through transitions.

3.3 MORTAR BEDDING AND JOINTING

A. Lay concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on exterior walls and in all courses of piers, columns and pilasters, where solid CMU is used and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
   1. To ensure alignment of veneer block and block coursing, adjust block back-up by cutting block to insure alignment of coursing or use adjustable anchorage.
   2. Lay masonry walls with 3/8" joints unless otherwise shown on drawings.
   3. Tool joints flush.
   4. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

B. Stopping and Resuming Work: Rake back 1/2 block length in each course; do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required) and remove loose masonry units and mortar prior to laying fresh masonry.

C. Built-In Work:
   1. As the work progresses, build in items specified under this and other Sections of these specifications. Fill in solidly with masonry around built-in items.
   2. Mortar in metal items embedded or built into masonry work solidly with mortar as the masonry units are laid up.
   3. Grout under lintels, bearing plates, and steel bearing on masonry with solid bed grout.
   4. Fill vertical cells of masonry units solid with grout which have anchoring, reinforcing rods, supporting or hanging devices embedded in the cell including stone anchors and window or curtain wall anchors.
   5. Fill vertical cells of masonry units solid with mortar on each side to sixteen (16) inches beyond.
   6. Unless otherwise noted, fill vertical cells of masonry units solid with grout which are below structural elements, to eight (8) inches beyond bearing and from foundation to bearing.
   7. Place wire mesh in horizontal joint below masonry unit cells to be filled with mortar, to prevent mortar from dropping into unfilled cells below.

8. Masonry indicated as being reinforced shall have all voids filled solid with grout. Grout shall be consolidated in place by vibration or other methods which insure complete filling of cells. When the least clear dimension of the grouted cell is less than two (2) inches, the maximum height of grout pour shall not exceed twelve (12) inches.
9. When the least clear dimension is two (2) inches or more, maximum height of grout pour shall not exceed forty-eight (48) inches. When grouting is stopped for one (1) hour or longer, the grout pour shall be stopped 1-1/2" below the top of a masonry unit. Vertical bar reinforcing shall be accurately placed and held in position while being grouted, and shall be in place before grouting starts. All such reinforcing shall have a minimum clear cover of 5/8". Lap all bars a minimum of forty (40) bar diameters and provide steel spacer ties (not to exceed 192 bar diameter) to secure and position all vertical steel and prevent displacement during grouting. Provide continuous horizontal reinforcement embedded in mortar joints every second course.

D. Cutting and Patching:
1. All exposed masonry which requires cutting or fitting shall be cut accurately to size with motorized carborundum or diamond saw, producing cut edges.
2. Do not saw cut any masonry openings in face brick construction without Architect's approval and after a procedure has been reviewed and approved.
3. Holes made in exposed masonry units for attachment of handrail brackets and similar items shall be neatly drilled to proper size.
4. All masonry which requires patching in exposed work, if approved by Landscape Architect, shall be patched neatly with mortar to match appearance of masonry as closely as possible and to the Landscape Architect's satisfaction. Rake back joints and use pointing mortar to match as required.

E. Ties and Anchors for Masonry Construction:
1. 1. Provide ties and anchors as shown or specified, but not less than one metal tie, spaced not to exceed sixteen (16) inches o.c. horizontally and/or vertically. Provide additional ties within 1'-0" of all openings and adjacent to expansion joints and spaced not more than 16" apart around perimeter of openings.

F. Control and Expansion Joints:
1. Provide expansion, control and isolation joints in masonry as shown in approved shop drawings. Build in related items as the masonry work progresses.
2. CMU Control Joint Spacing: If location of control joints is not shown, place vertical joints spaced not to exceed 40'-0" o.c. In addition, locate joints at points of natural weakness in the masonry work, including the following:
    a. At structural column or joint between bay.
    b. Above control joints in the supporting structure.
    c. Below major openings at top of arch downward. Place at one side of arch for openings less than 6'-0" wide and at both sides for openings over 6'-0" wide.
    d. At reduction of wall thickness.
    e. Where masonry abuts supporting structure.
3. If additional joints are required, indicate same on approved shop drawings.
4. Keep mortar, ties, reinforcement and grout out of movement joints unless specifically indicated otherwise.

3.4 SEALANT INSTALLATION

A. Install back-up materials and sealants in clean, dry joints in accordance with manufacturer’s written recommendations.

B. Do not bridge expansion, control or isolation joints with mortar or other rigid materials.

C. Tool sealant to provide a neat, uniform profile, fully bonded to joint substrates and free of voids, wrinkles, bubbles or surface defects.

D. Protect adjacent masonry and finished surfaces from sealant staining and residue.

3.5 CLEANING

A. Upon completion of work on site, clean areas within contract limits. Remove tools, equipment, debris, rubbish and excess materials. Leave site in broom clean condition.

B. The Contractor shall take adequate precautions for the protection of all surfaces against mortar spatter, and shall immediately remove any such spatter should it inadvertently occur, leaving no stain or discoloration.

C. Excess mortar shall be wiped off the masonry surfaces as the work progresses.

D. Wood coverings shall be placed over all such masonry surfaces as are likely to be damaged during the progress of the entire project.

E. Protective measures shall be performed in a manner satisfactory to the Landscape Architect.

F. Damaged masonry units shall be replaced to satisfaction of the Landscape Architect.

G. Exterior masonry walls shall be draped with waterproof covering until copings are in place, to prevent water penetration in cavity.

H. Cleaning of Masonry: Upon completion, all exposed masonry shall be thoroughly cleaned following recommendations of the NCMA Technical Notes. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 4' x 4' in a location approved by the Landscape Architect. No further cleaning work may proceed until the sample area has been approved by the Landscape Architect, after which time the same cleaning materials and method shall be used on the remaining wall area.

I. If stiff brushes and water do not suffice, the surface shall be thoroughly saturated with clear water and then scrubbed with a solution of an approved detergent masonry cleaner, equal to 'Vana Trol' made by ProSoCo Inc. or equal made by Diedrich or approved equal, mixed and applied as per manufacturer's directions, followed immediately by a thorough rinsing with clear water. All adjacent non-masonry surfaces shall be thoroughly protected during cleaning.

J. Do not use cleaning agents, acids, abrasives or methods that damage brick, limestone, mortar, sealants, metal components, adjacent paving, planting or other completed work.

3.6 FINAL INSPECTION AND PROTECTION

A. Inspect completed masonry for alignment, plumb, level, joint consistency, finish quality, cracks, chips, spalls, staining, open joints, damaged units and incomplete work.

B. Correct deficiencies identified by Landscape Architect. Replace damaged or unacceptable masonry units rather than attempting cosmetic repair where repair would be visible or would not restore the required appearance.

C. Maintain protective coverings until adjacent construction is sufficiently complete to prevent damage to completed masonry.

D. Leave completed garden wall clean, dry, protected and ready for acceptance.

END OF SECTION 32 32 19

SECTION 32 33 00 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Benches
2. Bike Racks
3. Tables
4. Chairs
5. Statuary
6. Decorative Planters
7. Rubbish Bins and Attachments
8. Habitat Features
9. Finials

B. Related Requirements:

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s product data, storage and handling requirements and recommendations, installation methods and available colors, styles, patterns and textures.

B. Shop Drawings: Submit manufacturer’s shop drawings, including plans and elevations, indicating overall dimensions. For custom built items, submit shop drawings indicating proposed hardware and any proposed alterations for constructability.

C. Samples: Submit manufacturer’s samples of materials, finishes, and colors.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

B. Warranty: Manufacturer’s standard warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with

the following:

1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B211.
2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B221.
3. Structural Pipe and Tube: ASTM B429/B429M.
4. Sheet and Plate: ASTM B209.
5. Castings: ASTM B26/B26M.

B. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A36/A36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A53/A53M, or electric-resistance-welded pipe complying with ASTM A135/A135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A500/A500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A513/A513M, or steel tubing fabricated from steel complying with ASTM A1011/A1011M and complying with dimensional tolerances in ASTM A500/A500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A1011/A1011M.
6. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F1267.
7. Malleable-Iron Castings: ASTM A47/A47M, grade as recommended by fabricator for type of use intended.
8. Gray-Iron Castings: ASTM A48/A48M, Class 200.

C. Stainless Steel: Free of surface blemishes and complying with the following:

1. Sheet, Strip, Plate, and Flat Bars: ASTM A240/A240M or ASTM A666.
2. Pipe: Schedule 40 steel pipe complying with ASTM A312/A312M.
3. Tubing: ASTM A554.

D. Anchors, Fasteners, Fittings, and Hardware: Galvanized steel; commercial quality.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on-grade substrate; extent as indicated.
2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; extent as indicated on Drawings.

E. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M; recommended in writing by manufacturer, for exterior applications.

F. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

G. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:

1. Hot-Dip Galvanizing: According to ASTM A123/A123M, ASTM A153/A153M, or ASTM A924/A924M.

H. Benches

1. Garden Bench

a. Style: Cordia
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder Coated Aluminum
e. Manufacturer: Forms + Surfaces, mark.tepper@forms-surfaces.com, 516.993.3765, or approved equal.
f. Color: refer to schedule
g. Attachment: surface mount, custom brackets

2. Park Bench

a. Style: Cordia
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder Coated Aluminum
e. Manufacturer: Forms + Surfaces, mark.tepper@forms-surfaces.com, 516.993.3765, or approved equal.
f. Color: refer to schedule
g. Attachment: surface mount, custom brackets

3. Swing Bench

a. Style: Carnival Swing Bench CRBS-HS-6-IG
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder Coated Steel
e. Manufacturer: Thomas Steele, sales@thomas-steele.com, 608.849.1080, 800.241.2505, or approved equal.
f. Color: refer to schedule
g. Attachment: In Ground Mount

I. Bike Racks

a. Style: Eleven Bike Rack
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder coated stainless steel
e. Manufacturer: Forms + Surfaces, mark.tepper@forms-surfaces.com, 516.993.3765, or approved equal.
f. Color: refer to schedule

g. Attachment: surface mount

J. Tables

1. Water Garden Café Table

a. Style: Feolin Café Table with 30” Tound Adams Big Top
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder Coated Aluminum
e. Manufacturer: McKinnon and Harris, cdriskill@mckinnonharris.com, 212.371.8260, or approved equal.
f. Color: refer to schedule

K. Chairs

1. Water Garden Café Chair

a. Style: Chesapeake Dining Arm Chair
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Powder Coated Aluminum, Synthetic Woven Rush
e. Manufacturer: McKinnon and Harris, cdriskill@mckinnonharris.com, 212.371.8260, or approved equal.
f. Color: refer to schedule

L. Statuary

1. Small Frog Statue

a. Style: Woodland Frog
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Cast Stone
e. Manufacturer: Campania International, projects@campaniainternational.com, 215.541.4330, or approved equal.
f. Color: Verde

2. Large Frog Statue

a. Style: Giant Garden Frog
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Cast Stone
e. Manufacturer: Campania International, projects@campaniainternational.com, 215.541.4330, or approved equal.
f. Color: Verde

3. Duck Statue

    a. Style: Quackers
    b. Qty: Refer to schedule
    c. Size: refer to schedule
    d. Material: Cast Stone
    e. Manufacturer: Campania International, projects@campaniainternational.com, 215.541.4330, or approved equal.
    f. Color: French Limestone

4. Pig Statue

    a. Style: Curly
    b. Qty: Refer to schedule
    c. Size: refer to schedule
    d. Material: Cast Stone
    e. Manufacturer: Campania International, projects@campaniainternational.com, 215.541.4330, or approved equal.
    f. Color: French Limestone

5. Rabbit Statue

    a. Style: Father Rabbit
    b. Qty: Refer to schedule
    c. Size: refer to schedule
    d. Material: Cast Stone
    e. Manufacturer: Campania International, projects@campaniainternational.com, 215.541.4330, or approved equal.
    f. Color: French Limestone

M. Decorative Planters

1. Decorative Planter 1

    a. Style: Artisan Rolled Rim Planter, Small
    b. Qty: Refer to schedule
    c. Size: refer to schedule
    d. Material: Frost Free Ceramic
    e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
    f. Color: Terra Cotta

2. Decorative Planter 2

    a. Style: Artisan Rolled Rim Planter, Medium
    b. Qty: Refer to schedule
    c. Size: refer to schedule
    d. Material: Frost Free Ceramic

e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
f. Color: Terra Cotta

3. Decorative Planter 3

a. Style: Artisan Rolled Rim Planter, Medium
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Frost Free Ceramic
e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
f. Color: Terra Cotta

4. Decorative Planter 4

a. Style: Rose Planter
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Frost Free Ceramic
e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
f. Color: Terra Cotta

5. Decorative Planter 5

a. Style: Garland Planter
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Frost Free Ceramic
e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
f. Color: Terra Cotta

6. Decorative Planter 6

a. Style: Lemon Planter
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Frost Free Ceramic
e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com, 973.467.8266, or approved equal.
f. Color: Terra Cotta

7. Decorative Planter 7

a. Style: Acanthus Leaf Planter
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Frost Free Ceramic
e. Manufacturer: Seibert and Rice, terracotta@seibert-rice.com,

973.467.8266, or approved equal.
f. Color: Terra Cotta

8. Urn Planter 1

a. Style: Winslow Vase
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Cast Stone
e. Manufacturer: Haddonstone, 32207 United Avenue, Pueblo, Co 81001, or approved equal.
f. Color: Wheat

9. Urn Planter 2

a. Style: State Vase
b. Qty: Refer to schedule
c. Size: refer to schedule
d. Material: Cast Stone
e. Manufacturer: Haddonstone, 32207 United Avenue, Pueblo, Co 81001, or approved equal.
f. Color: Wheat

N. Rubbish Bins and Attachments

1. Rubbish Bin

a. Style: Urban Renaissance Receptacle w/ custom Pineapple Grillwork
b. Configuration: Side Opening, Dome lid, standard lift latch
c. Qty: Refer to schedule
d. Size: 36 Gallon, 26.5" D X 39.5" H
e. Material: Powder Coated Stainless Steel
f. Manufacturer: Forms + Surfaces, mark.tepper@forms-surfaces.com, 516.993.3765, or approved equal.
g. Color: refer to schedule
h. Attachment: surface mount with levelers

2. Dog Waste Bag Dispenser

a. Style: Trail Proven™ Mini Dog Waste Station
b. Qty: Refer to schedule
c. Size: Refer to schedule
d. Material: Trail Wood™ -made from recycled plastics
e. Manufacturer: Mutt Mitt, info@muttmitt.com, 800.697.6084, or approved equal.
f. Color: Tree Bark Brown
g. Attachment: Direct Burial

O. Habitat Features

1. Bird Houses:

a. Material: Clear Cedar or approved equal,
b. Dimensions: As noted on drawings
c. Installation: As noted on drawings
d. Baffle and Metal Roof: Powder coated aluminum, Anthracite RAL 7016
e. Fasteners: All stainless steel are concealed, plugged and sanded

2. Insect Hotel:

a. Material: Clear Cedar or approved equal
b. Dimensions: As noted on drawings
c. Installation: As noted on drawings

P. Finials

1. Product: Ham House Pineapple, by Haddonstone, 32207 United Avenue, Pueblo, CO 81001, or approved equal.

a. 32 ¼ inches by 11 ¾” x 18” height
b. Color: Wheat

2.2 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Assembly: Shop assembled benches.

C. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.3 ALUMINUM FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.4 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.5 IRON FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.6 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run directional finishes with long dimension of each piece.
2. Directional Satin Finish: ASTM A480/A480M, No 4.
3. Dull Satin Finish: ASTM A480/A480M, No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. For custom built pieces, construct according to approved shop drawings.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

END OF SECTION 32 33 00

SECTION 32 34 13 – FABRICATED BOARDWALK AND BRIDGES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast concrete boardwalk system, consisting of precast concrete tread (deck) units and precast concrete beams.
2. Toe kick, integral or attached.
3. Coordination requirements with foundation systems.
4. Fence and gate connection bracket, supplied by boardwalk manufacturer for attachment of fence and gate specified under separate section.
5. Coordination review of bridge decking, truss, and handrail.

B. Related Requirements:

1. Section 32 31 19 Decorative Metal Fences and Gates.

1.2 REFERENCES

A. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.

B. ASTM A615/A615M – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

C. ACI 318 – Building Code Requirements for Structural Concrete.

D. AASHTO LRFD Bridge Design Specifications, current edition.

E. ADA Standards for Accessible Design, current edition.

1.3 SUBMITTALS

A. PRODUCT DATA:

1. Manufacturer’s printed data for the precast boardwalk system, including standard tread and bearer dimensions, unit thickness, connection hardware, and finish/color options.
2. Manufacturer’s printed data for the bridge truss and handrail system.

B. SHOP DRAWINGS:

1. Shop drawings to be submitted to Landscape Architect for coordination and review prior to fabrication.

2. Submit shop drawings for each boardwalk segment showing:

    a. Overall boardwalk layout (plan and profile)
    b. Individual tread layout and dimensions
    c. Toe kick connection detail
    d. Toe kick play layout, showing full run of toe kick along the boardwalk and indicating all locations where toe kick breaks or is interrupted (e.g., at access points, bridge transitions, intersection paths, or other planned gaps)
    e. Fence and gate connection bracket detail — connection point(s) supplied by boardwalk manufacturer for attachment of fence and gate (specified under Section 32 31 19) to boardwalk structure.

C. SAMPLES:

1. Submit two 12" x 12" (minimum) physical samples of the precast tread unit for approval prior to fabrication.
2. Submit two 12" x 12" (minimum) physical samples of standard finish/color options, as applicable to the manufacturer selected, for Landscape Architect approval prior to fabrication.

D. ENGINEERING SUBMITTALS

1. Manufacturer to provide the following, sealed by a Professional Engineer licensed in the state of the project (manufacturer's engineer of record for the boardwalk system), submitted by Contractor prior to fabrication:

    a. Reinforcement layout, including bar, mesh, and/or fiber reinforcement type, size, spacing, and placement within precast tread and beam units, as applicable to manufacturer's standard design. Provide these documents sealed by Professional Engineer licensed in the state of the project (manufacturer's engineer of record for the boardwalk system).
    b. Structural design calculations demonstrating that the precast boardwalk system meets or exceeds the design loading criteria specified in Section 1.5, including concentrated (point) load capacity. Provide these documents sealed by Professional Engineer licensed in the state of the project (manufacturer's engineer of record for the boardwalk system).
    c. Pile design calculations and layout, demonstrating pile type, spacing, and embedment adequate for point loads furnished by boardwalk manufacturer (Section 2.3) and project geotechnical report. Foundation supplier to provide, sealed by Professional Engineer licensed in the state of the project (foundation supplier's engineer of record).

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Boardwalk system shall be manufactured by a firm regularly engaged in the fabrication of precast concrete boardwalk/pedestrian

structures, with a minimum of five (5) comparable installed projects.

B. Installer Qualifications: Installation shall be performed by the manufacturer's authorized installer or by a Contractor trained and approved by the manufacturer.

C. Mockups:

1. Boardwalk Mockup: Build mockup of boardwalk assembly, minimum 12 linear feet, including precast tread and beam units, foundation connection, toe kick, and fence, to verify material, color, finish, and assembly selections and to set quality standard for fabrication and installation.
2. Approved mockups establish the standard by which the completed work will be judged.
3. Do not proceed with fabrication or installation of remaining boardwalk work beyond the mockup until mockup has been reviewed and approved by Landscape Architect.
4. Subject to compliance with requirements, approved mockup may remain as part of the completed Work if undisturbed at time of substantial completion.

1.5 PERFORMANCE REQUIREMENTS

A. Design Loading: Precast tread and beam units to meet or exceed manufacturer's standard published design loading, including uniform pedestrian live load and concentrated (point) load capacity, and comply with governing building code minimums, whichever is greater.

1. Manufacturer to be responsible for providing engineering drawings and design calculations demonstrating compliance with this section, sealed by a Professional Engineer licensed in the state of the project per Section 1.3.D.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle precast concrete tread and beam units in strict accordance with manufacturer's written instructions.

B. Store units off the ground on dunnage, at locations and in a manner per manufacturer's written instructions, protected from damage.

C. Handle units using lifting points, methods, and equipment specified by manufacturer. Do not lift, move, or place units by methods not approved by manufacturer.

1.7 WARRANTY

A. Contractor to submit warranty terms and documentation from each manufacturer and foundation supplier listed in Section 2.1, prior to selection, for Landscape

Architect and Owner review as part of manufacturer/supplier selection.

B. Selected manufacturer to provide minimum ten (10) year standard warranty against material defects for the precast concrete boardwalk system, including finish/color defects such as fading, chalking, or delamination beyond manufacturer's published tolerances.

C. Selected foundation supplier to provide minimum ten (10) year standard warranty against material and installation defects for the pile foundation system.

D. Warranty terms shall be a factor in Landscape Architect and Owner's review and approval of manufacturer and foundation supplier selection, per Section 2.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. PermaTrak

1. Contact: Jonathan Dove / Email: jdove@permatrak.com / Phone: 956-229-1848
2. Color: “Savannah Brown” (subject to sample approve per section 1.3.C.)
3. Finish: “Permaplank” (subject to sample approve per section 1.3.C.)
4. Website: www.permatrak.com

B. TerraTread

1. Contact: Bryan Martin / Email: bmartin@terratread.com / Phone: 419-351-5412
2. Color: Not selected. Contractor to submit full range of available standard finish/color samples for Landscape Architect review and selection, per Section 1.3.C.
3. Finish: Not selected. Contractor to submit full range of available standard finish/color samples for Landscape Architect review and selection, per Section 1.3.C.

C. York Bridge Concepts

1. Contact: Brian Kennedy / Email: bkennedy@ybc.com / Phone: 813-956-1763
2. Website: www.ybc.com
3. System: Composite decking on timber stringers, subject to Owner approval.

D. Foundation Suppliers: Boardwalk beams to bear on a pile foundation system furnished by one of the following or approve equal:

1. Helical Concepts, Inc.

a. Contact: Josh Lindberg / Email: josh@helicalpier.com / Phone: 214

803-0207

b. Website: www.helicalpier.com

2. Sinacola, LLC

a. Contact: Anthony Sinacola / Email: asinacola62@gmail.com / Phone: 419-705-4913

3. Approved equal.

2.2 MATERIALS

A. Precast Concrete Tread Units: Manufacturer's standard precast concrete tread (deck) unit, reinforced per manufacturer's engineered design for the specified span and loading. Joint spacing between treads to comply with ADA standards for openings in walking surfaces, and to be coordinated to match bridge decking joint spacing per Section 2.2.F, subject to Landscape Architect approval.

B. Precast Concrete Beams: Manufacturer's standard precast concrete beam, supporting tread units and connecting to foundation pile via threaded bar connection with 1/8" rubber leveling pad, reinforced per manufacturer's engineered design.

C. Reinforcement: Per manufacturer's standard design, conforming to ASTM A615/A615M or manufacturer's proprietary reinforcement system.

D. Finish: Manufacturer's standard integral color finish; color as selected (Savannah Brown or approved equal).

E. Connection Hardware: Per manufacturer’s specifications.

F. Bridge Decking: Concrete decking at bridge to be the same precast concrete tread system specified in Section 2.1 and 2.2.A, by the same manufacturer selected for the boardwalk. If not feasible, bridge decking to match boardwalk decking in material, color, texture, width, and joint spacing, subject to Landscape Architect approval.

2.3 FOUNDATION SYSTEM

A. Pile Type Determination: Pile type (helical or drilled/grouted micropile) to be determined by the foundation supplier selected per Section 2.1, based on:

1. Point load and reaction data provided by the boardwalk manufacturer (Section 2.3.B) for the selected boardwalk system.
2. Project geotechnical report.
3. Foundation supplier to submit recommended pile type, layout, and design calculations, sealed by foundation supplier's professional engineer.

B. Coordination: Boardwalk manufacturer to furnish point load and reaction data to the selected foundation supplier, who will coordinate final pile layout, spacing,

and embedment based on geotechnical report and structural engineer review.

2.4 TOE KICK

A. Provide continuous toe kick along one side of boardwalk (side without fence)

B. Provide joint filler material at toe kick joints per manufacturer's specifications.

C. Confirm with selected manufacturer whether toe kick is available as a standard or optional integral component prior to bid; note in shop drawings which method (manufacturer-provided or contractor-built) is being used.

2.5 FENCE AND GATE AT BOARDWALK

A. Fence/gate at Boardwalk is specified under Section 32 31 19 – Decorative Metal Fences and Gates.

B. Boardwalk manufacturer to supply connection bracket for attachment of fence/gate to boardwalk structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify foundation system (helical piles or micropiles) is installed, cured/set, and within tolerance per manufacturer's requirements prior to placing beam and tread units.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Verify boardwalk layout and elevations against Drawings and field conditions prior to fabrication of precast units.

B. Coordinate pile locations with foundation supplier's approved layout.

3.3 INSTALLATION

A. Install precast boardwalk tread and beam units in accordance with approved shop drawings and manufacturer's written installation instructions.

B. Coordinate beam-to-pile connection with foundation installer.

C. Install toe kick continuously along designated side.

D. Install fence and gate connection brackets per Sections 2.5; coordinate fence and gate installation with Section 32 31 19.

E. Do not proceed with installation of boardwalk beyond mockup extent until mockup is reviewed and approved by Landscape Architect, per Section 1.4.C.

3.4 TOLERANCES

A. Install tread and beam units level and true to line, per manufacturer's published tolerances.

3.5 FIELD QUAILTY CONTROL

A. Landscape Architect to review installed boardwalk for conformance with approved samples, mockup, and shop drawings prior to acceptance.

3.6 PROTECTION

A. Protect installed units from construction traffic and damage until substantial completion.

END OF SECTION 32 34 13

SECTION 32 84 00 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Drip irrigation specialties.
13. Controllers.
14. Boxes for automatic control valves.

B. Related Requirements:

1. Section 220500 "Common Work Results for Plumbing" for water metering requirements.

1.2 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. ET Controllers: EvapoTranspiration Controllers. Irrigation controllers, which use some method of weather-based adjustment of irrigation. These adjusting methods include use of historical monthly averages of ET, broadcasting of ET measurements, or use of on-site sensors to track ET.

D. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Pipes, tubes, and fittings.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Drip irrigation specialties.
13. Controllers.
14. Boxes for automatic control valves.
15. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated Design Submittals: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Irrigation systems, drawn to scale, on which components are indicated and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions, such as signs and light standards.

B. Zoning Chart: Indicate each irrigation zone and its control valve.

C. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Qualification Statements: For Installer.

F. Delegated design engineer qualifications.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers, controllers, and, automatic control valves to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of maintenance material items.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs a Certified Irrigation Designer - Landscape qualified by the Irrigation Association.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support piping to prevent sagging and bending.

1.9 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Irrigation Zone Control: Automatic operation with controller and automatic control valves.

B. Delegated Design: Design 100 percent coverage irrigation system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 psig.
2. Circuit Piping: 150 psig.

2.2 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Galvanized-Steel Pipe: ASTM A53/A53M, Standard Weight, Type E, Grade B.

1. Galvanized-Steel Pipe Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Standard Weight, seamless-steel pipe with threaded ends.
2. Galvanized, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
3. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
4. Cast-Iron Flanges: ASME B16.1, Class 125.

C. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111 rubber.

E. Soft Copper Tube: ASTM B88, Type L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

F. Hard Copper Tube: ASTM B88, Type L,, and, ASTM B88, Type M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

G. PE Pipe with Controlled ID: ASTM D2239, PE 3408 compound; SIDR 11.5, and, SIDR 15.

1. Insert Fittings for PE Pipe: ASTM D2609, nylon or propylene plastic with barbed ends. Include bands or other fasteners.

H. PE Pipe with Controlled OD: ASTM D3035, PE 3408 compound, SIDR 11.

1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
2. PE Socket-Type Fittings: ASTM D2683.

I. PE Pressure Pipe: AWWA C906, with DR of 7.3, 9, or 9.3 and PE compound number required to give pressure rating of not less than 200 psig.

1. PE Butt, Heat-Fusion Fittings: ASTM D3261.
2. PE Socket-Type Fittings: ASTM D2683.

J. PVC Pipe: ASTM D1785, PVC 1120 compound, Schedules 40 and 80.

1. PVC Socket Fittings: ASTM D2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D2464, Schedule 80.
3. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

K. PVC Pipe, Pressure Rated: ASTM D2241, PVC 1120 compound, SDR 21, and, SDR 26.

1. PVC Socket Fittings: ASTM D2467, Schedule 80.
2. PVC Socket Unions: Construction similar to that of MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Solder Filler Metals: ASTM B32, lead-free alloys. Include water-flushable flux in accordance with ASTM B813.

E. Solvent Cements for Joining PVC Piping: ASTM D2564. Include primer in accordance with ASTM F656.

F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105.

B. Form: Sheet or tube.

C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

D. Color: Black.

2.5 MANUAL VALVES

A. Curb-Valve Casing:

1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

B. Shutoff Rods for Curb-Valve Casings: Furnish two steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

C. Iron Gate Valve Casings:

1. Standard: AWWA M44 for cast-iron valve casings.
2. Top Section: Adjustable extension of length required for depth of burial of valve.
3. Barrel: Approximately 5-inch diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

D. Operating Wrenches for Iron Gate Valve Casings: Furnish two steel, tee-handle operating wrench(es) with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.

2.6 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.7 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch- diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.10 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

2.11 BOXES FOR AUTOMATIC CONTROL VALVES

A. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch minimum to 3 inches maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

D. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 36 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
2. Circuit Piping: 12 inches.
3. Drain Piping: 12 inches.
4. Sleeves: 24 inches.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 INSTALLATION OF PIPING

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Install expansion loops in control-valve boxes for plastic piping.

I. Lay piping on solid subbase, uniformly sloped without humps or depressions.

J. Install ductile-iron piping in accordance with AWWA C600.

K. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

L. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.

M. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.

N. Install piping in sleeves under parking lots, roadways, and sidewalks.

O. Install sleeves made of Schedule 80, PVC pipe and socket fittings, and solvent-cemented joints.

P. Install transition fittings for plastic-to-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
b. NPS 2 and Larger: AWWA transition couplings.

2. Aboveground Piping:

a. NPS 2 and Smaller: Plastic-to-metal transition unions.
b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

Q. Install dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
b. NPS 2-1/2 and Larger: Prohibited except in control-valve box.

2. Aboveground Piping:

a. NPS 2 and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4: Dielectric flange.
c. NPS 5 and Larger: Dielectric flange kit.

3. Piping in Control-Valve Boxes:

a. NPS 2 and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4: Dielectric flange.
c. NPS 5 and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material of size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. Copper-Tubing Brazed Joints: Construct joints in accordance with CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

G. Copper-Tubing Soldered Joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.

H. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners in accordance with piping manufacturer's written instructions.

I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

J. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings in accordance with the following:

1. Comply with ASTM F402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings in accordance with ASTM D2672. Join other-than-schedule-number PVC pipe and socket fittings in accordance with ASTM D2855.
3. PVC Nonpressure Piping: Join in accordance with ASTM D2855.

3.5 INSTALLATION OF VALVES

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves. Install full-size valved bypass.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 INSTALLATION OF AUTOMATIC IRRIGATION CONTROL SYSTEM

A. Equipment Mounting, Interior: Install controllers on interior wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Equipment Mounting, Exterior: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install control cable in same trench as irrigation piping and at least 2 inches below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.7 CONNECTIONS

A. Comply with requirements for piping specified in Section 331415 "Site Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.9 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations,

including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service with Test Assistance: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Irrigation system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that controllers are installed and connected in accordance with the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.11 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.12 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.13 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic

control valves, and controllers.

3.14 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Aboveground Irrigation Main Piping:

1. NPS 4 and Smaller:

a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
b. Type M hard copper tube, wrought- or cast-copper fittings, and brazed joints.
c. Schedule 80, PVC pipe; socket-type PVC fittings; and solvent-cemented joints.
d. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

2. NPS 5 and Larger:

a. Galvanized-steel pipe and galvanized-steel pipe nipples; galvanized, gray-iron threaded fittings; and threaded joints.
b. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
c. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

D. Underground Irrigation Main Piping:

1. NPS 4 and Smaller:

a. NPS 3 and NPS 4 ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
b. NPS 3 and NPS 4 ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
c. Type L soft copper tube, wrought-copper fittings, and brazed joints.
d. NPS 4 PE pressure pipe; PE butt, heat-fusion or socket-type fittings; and heat-fusion joints.
e. Schedule 80, PVC pipe and socket fittings, and solvent-cemented joints.
f. Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.
g. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

2. NPS 5 and Larger:

a. NPS 6 and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
b. NPS 6 and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
c. PE pressure pipe; PE butt, heat-fusion fittings; and heat-fusion joints.
d. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
e. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

E. Circuit Piping:

1. NPS 2 and Smaller:

a. SIDR 9, PE, controlled ID pipe; insert fittings for PE pipe; and fastener joints.
b. DR 11, PE, controlled OD pipe; PE butt, heat-fusion, or PE socket-type fittings; and heat-fusion joints.
c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

2. NPS 2-1/2 to NPS 4:

a. SIDR 9, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
b. DR 11, PE, controlled OD pipe; PE socket or butt-fusion fittings; and heat-fusion joints. NPS 3 pipe and fittings if NPS 2-1/2 pipe and fittings are not available.
c. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
d. SDR 26, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

F. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

G. Risers to Aboveground Sprinklers and Specialties:

1. Type M hard copper tube, wrought-copper fittings, and brazed joints.
2. Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

H. Drain piping shall be one of the following:

1. SIDR 9, 11.5, or 15; PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
2. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
3. SDR 21, 26, or 32.5; PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

3.15 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 and Smaller: Curb valve, curb-valve casing, and shutoff rod.
2. NPS 3 and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrench(es).

B. Aboveground, Shutoff-Duty Valves:

1. NPS 2 and Smaller:

    a. Brass or bronze ball valve.
    b. Bronze gate valve.

2. NPS 2-1/2 and Larger:

    a. Iron gate valve, NRS.

C. Throttling-Duty Valves:

1. NPS 2 and Smaller:

    a. Brass or bronze ball valve.

2. NPS 2-1/2 and NPS 3:
3. Iron ball valve.

D. Drain Valves:

1. NPS 1/2 and NPS 3/4:

    a. Brass or bronze ball valve.
    b. Bronze gate valve.

2. NPS 1 to NPS 2:

    a. Bronze gate valve.

END OF SECTION 32 84 00

SECTION 32 91 15 - SOIL PREPARATION (PERFORMANCE SPECIFICATION)

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes planting soils specified according to performance requirements of the mixes.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
3. Section 329300 "Plants" for placing planting soil for plantings.

1.2 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of imported soil, soil amendment, and fertilizer before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Landscape Architect seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Architect under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples where directed by Architect for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."

3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

    a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Bulk Density: Analysis according to core method of SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
5. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85 percent compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with

appropriate certificates.

PART 2 - PRODUCTS

2.1 PLANTING SOIL TYPE A: NEW TOPSOIL

A. Manufactured soil blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials as specified in other articles of this Section to produce viable planting soil.

1. Less than 10% #4 gravel,
2. 45-75 of #18, very coarse sand, #35 Corse Sand, #60 Medium Sand, #140 Fin Sand, #200 Very fine Sand
3. 5.0-35% silt
4. 5.0-20% Clay
5. Acceptable Textural soil types: Loam, Silt Loam, Sandy Loam, Clay Loam
6. Ph: 6-7.7
7. Organic Matter: 5-7%
8. Soluble Salts: less than 2%
9. Cation Exchange capacity: 5-25%

2.2 PLANTING SOIL TYPE B: AMENDED FOR PLANTINGS

A. Existing, on-site surface soil, with all existing lawn removed; modified to produce viable planting soil.

1. Remediate existing soils within proposed planting areas prior to planting to improve soil structure, biological activity, water-holding capacity, aeration, and organic matter while avoiding unnecessary additions of nutrients already present at elevated levels.
2. Soil amendments shall be incorporated only after completion of rough grading and confirmation that soils are reasonably dry and friable.
3. Do not perform soil amendment operations when soil is saturated, frozen, or sufficiently wet that compaction or smearing may occur.

B. Using preconstruction soil analyses and materials from the September 2025 report from University of Arkansas Soil Test & Research Laboratory, amend existing, on-site surface soil to become planting soil complying with the following requirements:

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
pH	5.8	6.2	6.0	6.2	6.2
Phosphorus	64	164	68	44	30 ppm
Potassium	203	260	166	174	171 ppm
Zinc	9.2	31.5	15.2	11.3	10.3 ppm
Organic Matter	4.0%	3.6%	4.5%	3.8%	2.9%
CEC	12	18	9	11	15

1. Organic amendment

    a. Mature, stable, low-salt compost
    b. Preferably low phosphorus
    c. Incorporate approximately 1–2 inches into the planting soil
    d. Target a finished organic matter level around 4–5%, rather than trying to drive it extremely high.
    e. Compost shall be fully mature and free of viable weed seeds.
    f. Compost shall be derived primarily from composted plant material, not composted manure.
    g. Compost shall have a low soluble-salt content.
    h. Compost shall have a documented nutrient analysis.
    i. Do not use compost with excessive phosphorus or potassium.
    j. Contractor shall submit compost analysis to Landscape Architect for approval prior to delivery.
    k. Application: apply 1.5 inches compost per 1,000 SF for turf areas

        1) perennial planting beds, ornamental grasses, groundcovers, and shrub planting areas:
        2) Incorporate compost uniformly into the existing soil to a depth of 12 inches.
        3) Do not incorporate large quantities of compost throughout the root zone of existing mature trees.

2. pH

    a. No blanket liming.
    b. Adjust only areas testing below the desired range.
    c. Sample #1 warrants further lime-requirement testing because pH is 5.8.

3. Fertilizer

    a. No phosphorus fertilizer
    b. No routine potassium fertilizer
    c. No zinc-containing fertilizer
    d. Don't use a standard "complete" fertilizer such as 10-10-10.

e. Do not apply gypsum as a general soil amendment

4. Biological/structural improvement

a. Prioritize compost and organic matter.
b. Minimize unnecessary soil disturbance.
c. Avoid compaction during construction.
d. Maintain a surface mulch layer around trees and shrubs.

5. Soil Compaction

a. Prior to planting, remediate compacted areas by scarifying or loosening existing soil to a minimum depth of 12 inches.
b. Where construction traffic has resulted in severe compaction, loosen soil to the maximum practical depth without damaging existing utilities, roots, drainage systems, or adjacent structures.
c. Do not work saturated soils

6. Final Soil Condition

a. Upon completion of remediation, planting soil shall:
b. Be friable and capable of being worked by hand.
c. Be free of construction debris, concrete, asphalt, trash, and deleterious material.
d. Be free of large clods and compacted layers.
e. Drain freely without excessive ponding.
f. Contain uniformly distributed organic amendment.
g. Have adequate pore space for root growth.
h. Not contain visible concentrations of fertilizer salts.
i. Not contain excessive phosphorus or potassium from amendments.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
2. Form: Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: Limited to leaves.
2. Reaction: pH of 5.5 to 8.
3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 30 to 40 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.

B. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 EXAMINATION

A. Verify that rough grading is substantially complete.

B. Verify that drainage patterns and elevations are established.

C. Verify that planting areas are free of construction debris, concrete, asphalt, petroleum contamination, and other deleterious materials.

D. Notify Landscape Architect of unsuitable conditions prior to proceeding.

3.3 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Existing lawn area excavation: For existing lawn areas to become plant beds,

excavate soil from designated areas to a depth of 4 inches and dispose off-site. After amendments to subgrade, regrade to existing grades or new finish grades as noted on Drawings with Planting Soil Type A. See Section 3.5 below.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: All new soil to contain a combined maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Protect existing soils designated to remain from compaction.

E. Limit construction traffic within future planting areas to the extent possible. Any soil areas compacted by construction access or activity shall be reconstructed according to Soil Type C.

F. Do not stockpile construction materials, equipment, or excavated materials within planting areas unless specifically approved

G. Protect existing trees and their root zones from construction traffic and excessive soil disturbance.

3.4 REMOVAL OF UNSUITABLE MATERIAL

A. Construction debris.

B. Concrete.

C. Asphalt.

D. Rubble.

E. Excessive gravel or stones.

F. Contaminated soil.

G. Other deleterious materials.

H. Notify Landscape Architect where unsuitable soil extends beyond anticipated excavation limits.

3.5 PLACING AND MIXING PLANTING SOIL OVER AMENDED SUBGRADE (PLANTING SOIL TYPES B AND C ONLY)

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: After turf layer is removed, till existing soil to a depth of 8 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 2 inches of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth of 12 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

a. Mix lime, and, sulfur with dry soil before mixing fertilizer.
b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 12 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 BLENDING PLANTING SOIL IN PLACE (SOIL TYPE D)

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 12 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D698.

D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.7 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Application: Apply compost component of planting-soil mix to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.8 FINAL SOIL PREPARATION

A. A. After amendment incorporation, rake planting areas smooth and remove stones and debris greater than 1 inch in any dimension.

B. Soil shall be:

1. Friable.
2. Uniformly amended.
3. Free of compacted layers.
4. Free-draining.
5. Free of construction debris.
6. Suitable for root development.
7. C. Avoid excessive compaction from construction equipment following soil preparation.

3.9 POST-AMENDMENT SOIL TESTING

A. A. Following soil amendment and prior to final planting, collect representative samples of amended soil.

B. B. Test for, at minimum:

1. pH.

C. Organic matter.

D. Phosphorus.

E. Potassium.

F. Calcium.

G. Magnesium.

H. CEC.

I. Electrical conductivity/soluble salts.

J. C. Submit laboratory results to Landscape Architect for review prior to planting.

K. D. If post-amendment testing indicates excessive phosphorus, potassium, zinc, soluble salts, or other nutrients, do not apply additional amendments without written approval.

3.10 ORGANIC MULCH INSTALLATION

A. A. Install approved organic mulch after completion of planting.

B. B. Provide uniform finished depth of:

C. 2 to 3 inches.

D. C. Keep mulch away from:

1. Tree trunks.
2. Shrub stems.
3. Perennial crowns.
4. Building foundations.
5. Drainage structures.
6. D. Do not incorporate mulch into soil.

3.11 ACCEPTANCE CRITERIA

A. A. Planting areas shall be considered acceptable when:

1. Soil has been loosened to the specified depth.
2. Approved compost has been uniformly incorporated.
3. No distinct amendment layer is present.
4. Soil is free of construction debris.
5. Soil is not visibly compacted.
6. Final grades are established.
7. Post-amendment soil testing has been submitted.
8. Required corrective amendments have been completed.

3.12 POST CONSTRUCTION LAWN AMENDMENT

A. Following completion of construction operations, inspect all lawn areas for soil compaction, rutting, settlement, erosion, debris, and other conditions resulting from construction activities

B. Remove construction debris, unsuitable soil, rocks, and other deleterious

materials from lawn areas. Scarify or till compacted soil to a minimum depth of 6 inches to restore suitable soil structure and infiltration.

C. Amend existing soil with approved topsoil and/or compost as required to restore soil fertility and establish suitable growing conditions. Incorporate amendments uniformly into the upper 6 inches of existing soil.

D. Regrade lawn areas to provide a smooth, uniform surface conforming to proposed grades and draining positively without low areas, ponding, or abrupt transitions.

E. Reseed, overseed, or resod lawn areas disturbed by construction in accordance with Section 32 92 00 – Turf and Grasses. Restore lawn areas to a condition equal to or better than that existing prior to construction.

F. Water and maintain restored lawn areas until established, including mowing, watering, fertilizing, and repair of bare or damaged areas as required.

G. Lawn areas shall be considered established when turf is uniformly rooted, actively growing, free of bare areas, weeds, erosion, and construction damage, and provides a consistent appearance with adjacent lawn areas.

3.13 SURFACE LEVEL AMENDMENTS TO LAWN

A. Evaluate existing lawn areas following completion of construction and identify areas requiring surface-level amendment due to minor compaction, settlement, thinning, or construction disturbance.

B. Mow existing lawn to a height of approximately 2 inches and remove clippings, leaves, debris, and other organic matter from the lawn surface.

C. Apply approved screened topsoil or lawn soil amendment uniformly over existing lawn at a maximum depth of 1/2 inch per application. Do not bury existing turf or create abrupt grade transitions at adjacent paving, curbs, walks, or planting areas.

D. Where additional amendment is required, apply in multiple light applications rather than a single deep application. Lightly rake or brush amendment into the existing turf canopy to achieve uniform distribution and maintain existing turf growth.

E. Overseed amended lawn areas with specified turf seed mix in accordance with Section 32 92 00 – Turf and Grasses. Incorporate seed into the upper surface of the amendment without disturbing established turf.

F. Repair areas exhibiting bare soil, erosion, settlement, or inadequate turf establishment. Maintain amended lawn areas until a uniform, healthy stand of turf is established.

G. Protect adjacent paving, curbs, planting areas, drainage structures, and other

finished surfaces from amendment materials and seed during application.

3.14 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Architect and replace contaminated planting soil with new planting soil.

3.15 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 91 15

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydroseeding.
2. Sodding.
3. Plugging.
4. Meadow grasses and wildflowers.
5. Erosion-control materials.
6. Grass-paving materials.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329115 "Soil Preparation (Performance Specification)" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand

or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the National Association of Landscape Professionals:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawn Care Manager.
    c. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass

Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.8 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

1. Spring Planting: June 01 - May 31.
2. Fall Planting: September 15 - October 31.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions. Landscape Architect to make final determination as to suitability of weather at time of planting.,

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
2. Full Sun, warm season grass:

a. 70% Bermuda Grass – (Cynodon dactylon)
b. 10% Bermuda Grass (Cynodon transvaalensis)
c. 20% Zosia Grass (Zoysia japonica)

3. Sun and Partial Shade,

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 50 percent chewings Tall Fescue (Festuca arundinacea).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Approved, Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species, warm-Season Grass: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Bermuda Grass – (Cynodon dactylon), a minimum of three cultivars.

2. Shade: Proportioned by weight as follows:

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 50 percent chewings Tall Fescue (Festuca arundinacea).

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

a. 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

A. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

B. Erosion-Control Coir Logs: Biodegradable spun coir fiber, 12" diameter, with a minimum of 5.5 lb/linear foot, minimum of 10 foot lengths, 2" x 2" openings.

C. Erosion-Control Stakes: Biodegradable, 4" length. Spacing to meet manufacturer standards.

2.6 GRASS-PAVING MATERIALS

A. Base Course: Sound crushed stone or gravel complying with ASTM D448 for Size No. 8.

B. Sod Stabilizing Panel: Core Grass 65-45, by Core Landscape Products, Comox, BC, Canada, or approved equal.

C. Sandy Loam Soil Mix: Sound, sharp, washed, natural sand or crushed stone complying with gradation requirements in ASTM C33/C33M for fine aggregate blended with planting soil A. Use blend consisting of 1/2 sand and 1/2 planting soil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Blend planting soil in place.

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control blanket, mesh, or coir log, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

C. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 PREPARATION FOR GRASS-PAVING MATERIALS

A. Reduce subgrade elevation soil to allow for thickness of grass-paving system. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade so that installed paving is within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions.

B. Install base course, and and sandy loam soil mix as recommended by paving-material manufacturer for site conditions and according to details indicated on Drawings. Compact according to paving-material manufacturer's written instructions.

C. Install paving mat and fasten according to paving-material manufacturer's written instructions.

D. Before planting, fill cells of paving mat with sandy loam soil mix and compact according to manufacturer's written instructions.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.6 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft..

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.7 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step

process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.8 SODDING

A. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.9 TURF RENOVATION

A. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.

1. Soil Amendment(s): Amend according to requirements of Section 329115 "Soil Preparation (Performance Specification)." Apply soil amendments at the rate of necessary levels to achieve specified ratios.
2. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.

I. Apply sod as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.10 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Kentucky bluegrass, buffalograss, annual ryegrass, chewings red fescue to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply commercial fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.11 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.12 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.13 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 30 days from date of Substantial Completion.

END OF SECTION 329200

SECTION 32 93 00 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Tree-stabilization materials.
7. Landscape edgings.
8. Tree-watering devices.
9. Riparian Upland Seed Mix.
10. Perennial and Bulb Mixes.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 328400 "Planting Irrigation" for complete irrigation systems.
3. Section 329200 "Turf and Grasses" for turf (lawn), hydroseeding, and erosion-control materials.
4. Section 329600 "Transplanting" for transplanting non-nursery-grown trees.

1.2 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Tree-stabilization materials.
6. Landscape edgings.
7. Tree-watering devices

B. Product Data Submittals: For each product.

1. Plant Materials: Include quantities, sizes, quality, and verified sources for plant materials.

C. Samples for Verification: Actual sample of finished products for each of the following:

1. Organic Mulch: 1-quart volume of each organic mulch required; typical of the lot of material to be furnished, in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Provide an accurate representation of color, texture, and organic makeup.
2. Weed-Control Barrier: 12 by 12 inches.
3. Landscape Edging: 12 inch length.

D. Riparian Upland Seed Mix:

1. Seed vendor's certified analysis for each species, including botanical name, PLS percentage, germination and dormant seed percentages, purity, weed seed content, lot number, and source location. Include vendor's conversion of specified seed count percentages and total seeding density to pounds of PLS per species for the total area indicated. Submit for Landscape Architect approval prior to procurement.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with manufacturer's certified analysis of standard products.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

B. Riparian Upland Seed Mix Maintenance Plan: Written management recommendations for the second and third growing seasons, including annual late-winter mowing or cutting schedule and height, spot weed control methods, identification of target invasive species, and prohibition on fertilizer and broadleaf-selective herbicide use.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Member in good standing of either the National Association of Landscape Professionals or American Hort.
2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure in accordance with ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

1. Notify Architect of sources of planting materials seven days in advance of delivery to site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if

applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, or walkways and pavements; or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

F. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.9 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: April 1 - May 31.
2. Fall Planting: October 1 - November 30.

C. Seeding Restrictions:

1. Riparian Upland Seed Mix Areas:

a. Install riparian upland seed mix during periods recommended by the seed vendor for the species specified, as approved by the Landscape Architect. Dormant seeding is acceptable where approved. Coordinate site preparation so that final herbicide application and seeding occur within the approved seeding period.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
b. Structural failures, including plantings falling or blowing over.
c. Faulty performance of tree stabilization.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Substantial Completion.

a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

B. Riparian Upland Seed Mix Areas:

1. Warranty requirements for individual plants do not apply to seeded areas. Seeded areas shall meet acceptance criteria in Part 3 at the end of the first full growing season following seeding. Reseed areas not meeting

acceptance criteria at no additional cost to Owner.

1.11 MAINTENANCE SERVICE

A. Maintenance Period: Begin maintenance immediately after each plant is installed and each area is seeded, and **continue through Substantial Completion**. This includes trees, shrubs, ground covers, perennials, and riparian upland seed mix areas. Maintenance shall be performed by skilled employees of the landscape Installer, as required in Part 3.

B. Watering: Contractor is responsible for providing all water required to establish and maintain plantings and seeded areas for the duration of the maintenance period.

1. Where a permanent irrigation system is not installed, is not yet operational, or does not serve a planted or seeded area, provide temporary watering by temporary irrigation, water truck, hoses, or other means acceptable to the Landscape Architect.
2. Operation of a permanent irrigation system does not relieve Contractor of responsibility for adequate watering. Supplement irrigation where coverage or volume is insufficient.

C. Transfer of Maintenance: At the end of the maintenance period, and following acceptance by the Landscape Architect, maintenance responsibility transfers to Owner. Coordinate a walkthrough with Owner's maintenance personnel prior to transfer to review the maintenance plan submitted under Article 1.6.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; with tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); with crossing trunks; with cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to ensure symmetry in planting.

F. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but are not yet in bloom.

G. FERTILIZERS

Granular Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

    a. 0.75 lb/1000 sq. ft.3 percent of actual nitrogen, 4 percent phosphorous, and 3 percent potassium, by weight.
    b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

H. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and maximum of 5.5 percent inert material.

2.2 RIPARIAN UPLAND SEED MIX

A. Seed: Fresh, clean, new-crop seed, labeled in accordance with state and federal seed laws. Straight species only; cultivars and selections are not acceptable. Source-identified seed from the Ozark ecoregion or within 250 miles of Project site, unless otherwise approved by the Landscape Architect.

B. Weed Seed Content: Not to exceed 0.5 percent by weight. Seed shall be free of state-listed noxious weed seed.

C. **Seeding Density: Minimum 100 PLS seeds per square foot.**

D. Seed Mix Composition: Percentages are by count of PLS seeds per square foot, not by weight

BOTANICAL NAME	**COMMON NAME**	**% of total PLS seed count**
GRASSES		
Schizachyrium scoparium	Little Bluestem	16
Bouteloua curtipendula	Side Oats Grama	12
Elymus hystrix	Bottlebrush Grass	6
Muhlenbergia capillaris	Pink Muhly	6
GRASSES SUBTOTAL		**40**
FORBS		
Echinacea purpurea	Purple Coneflower	9
Rudbeckia hirta	Black-Eyed Susan	8
Liatris aspera	Rough Blazing Star	7
Monarda fistulosa	Wild Bergamot	6
Penstemon digitalis	Foxglove Beardtongue	6
Asclepias tuberosa	Butterfly Milkweed	6
Rudbeckia fulgida	Perennial Black-Eyed Susan	5
Pycnanthemum tenuifolium	Slender Mountain Mint	5
Amsonia tabernaemontana	Eastern Bluestar	4

Amsonia illustris	Ozark Bluestar	4
FORBS SUBTOTAL		**60**

E. Substitutions: Where a specified species is unavailable from approved sources, submit proposed substitution of a regionally native species of similar height, habit, and bloom period for Landscape Architect approval. Do not substitute without written approval.

F. Nurse Crop: Annual cover crop appropriate to the seeding season, such as oats (Avena sativa) for spring and summer seeding or winter wheat (Triticum aestivum) for fall seeding, applied at a light rate as recommended by the seed vendor and approved by the Landscape Architect. The nurse crop is not included in the composition percentages.

G. Reserve Seed: In addition to the quantity required for initial seeding, furnish reserve seed equal to not less than 20 percent of the total initial seed quantity, of the same mix composition and from the same seed lots. Store reserve seed in sealed, labeled containers in a cool, dry, rodent-proof location until use.

2.3 PERENNIAL AND BULB MIXES

A. Plant material to be procured in the quantities indicated on Drawings at the ratios indicated below.

B. *Hosta* varieties:

1. ‘Blue Mouse Ears’
2. ‘Diamond Lake Hosta’
3. ‘Elegans’
4. ‘Halcyon Hosta’
5. ‘Guacamole’
6. ‘Empress Wu’
7. ‘Blueberry muffin’
8. ‘Abiqua Drinking Gourd’
9. ‘White Feather’
10. ‘Sum and Substance’
11. ‘Olive Bailey Langdon’
12. ‘Gentle Giant’

C. *Helleborus* varieties:

1. Helleborus ‘Ivory Prince’
2. Helleborus lividus
3. Helleborus Winter Jewels ‘Harlequin Gem’
4. Helleborus x hybridus ‘White Lady Spotted’

5. Helleborus ‘Dark and Handsome’
6. Helleborus ‘First Dance’
7. Helleborus ‘Onyx Odyssey’
8. Helleborus ‘Penny’s Pink’

D. *Paeonia* varieties:

1. Paeonia ‘Pieterje Vriend Wagenaar’
2. Paeonia ‘Raspberry Sundae”
3. Paeonia ‘Moonstone’
4. Paeonia ‘Angel Cheeks’
5. Paeonia ‘Big Ben’
6.

E. Bulb varieties:

1. Narcissus Palmares
2. Narcissus Dialogs
3. Narcissus Audbon
4. Narcissus Pom Pom Rose
5. Narcissus Replete
6. Narcissus bulbocodium White Petticote
7. Narcissus Regeneration
8. Crocus Chrys. Panda
9. Scilla bifolia rosea
10. Muscari latifolium ‘Grape Ice’
11. Muscari Pink Sunrise
12. Camassia quamash
13. Fritillaria perscia Twin Towers Tribute
14. Fritillaria perscia Green Dreams

2.4 HERBICIDE

A. Glyphosate Herbicide:

1. EPA-registered glyphosate formulation labeled for use in and adjacent to aquatic sites. Products containing surfactants not labeled for aquatic use are not acceptable. Adjuvants, if used, shall be labeled for aquatic use.

2.5 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers inert to biological degradation and naturally resistant to chemicals, alkalis, and acids, formed into a stable network so that fibers retain their relative position.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

C. Seeded Area Mulch: Certified weed-free straw, applied lightly as indicated in Part 3, or as otherwise approved by the Landscape Architect.

2.6 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches maximum, 1/2 inch minimum.

B. Pine Straw: Interlocking needles dried pine needles suitable as top dressing of sloped areas

1. Type: Pine Straw, natural dried with no artificial dyes.
2. Size: Long needle and Slash/ Loblolly

C. Fiber Reinforced Mulch: shredded virgin wood fiber with Fibar Mat

1. Product: Fibar Playground Safety Surfaces, 80 Business Park Drive, Suite 300 Armonk NY 10504, info@fibar.com
2. Depth: 12 in depth with 1% downward grade to ensure proper drainage to FibarDrain Drain Strip.
3. Drain Strip: 2 inch wide by 6 in depth: all perimeter area of all Fibar mulch
4. FibarFelt: 100% non woven geotextile material
5. Fibar Engineer Wood Fiber

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through a 1-inch sieve; soluble-salt content of 2 to 5 dS/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. No dyes or additives of any kind shall be present in any type of mulch.

F. Mulch products displaying any significant quantity of deleterious material (any material other than shredded hardwood) after installation will be rejected. Should mulch prove to include deleterious material in significant quantities, as defined by the Landscape Architect, the contractor shall either manually remove all deleterious material or remove and replace the mulch, as directed by the Landscape Architect.

2.7 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass

grommets.

B. Root-Ball Stabilization Materials:

1. Tree Staples: models indicated on drawings, by Tree Staples, Stirling, NJ, or approved equal.

2.8 TREE-WATERING DEVICES

A. Slow-Release Watering Bags: UV-resistant polyethylene bag designed to release water to the root ball over 5 to 9 hours through perforations in the bag base.

1. Single-Trunk Trees: Upright zippered bag, 20-gallon capacity. Basis of design: Treegator Original by Spectrum Products, Inc., or approved equal.
2. Multi-Stem and Low-Branching Trees: Ring-style bag that sits flat on the root ball, 15-gallon capacity. Basis of design: Treegator Jr. by Spectrum Products, Inc., or approved equal.

2.9 ALUMINUM EDGING

A. Acceptable Products:

1. Manufacturer: Planterworx 987 Essex Street Brooklyn, NY 11208

a. Model: Curved Edging System
b. Size: As indicated on drawings.
c. Material: .25” aluminum, alloy 5052.
d. Finish: Polyester-based marine-grade powdercoat finish.
e. Color: Carbon.

2. Manufacturer: Permaloc, Holland, MI 49424

a. Model: CleanLine Commercial Grade Landscape Edging
b. Size: As indicated on drawings.
c. Material: 3/16” aluminum.
d. Finish: Anodized.
e. Color: Black.

3. Approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until moisture content reaches acceptable levels to attain required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 RIPARIAN UPLAND SEED MIX AREA PREPARATION

A. Areas with Existing Vegetation:

1. Mow existing vegetation and allow regrowth to 4 to 6 inches of actively growing foliage before initial application.
2. Apply glyphosate herbicide to all existing vegetation within areas indicated. Do not apply when wind exceeds 10 mph, when rain is forecast within 24 hours, or in any manner that allows drift or runoff to the creek or adjacent areas.
3. Following a label-specified interval of not less than 14 days, apply a second treatment to any surviving vegetation and any new weed flush. Repeat as necessary until the area is free of live vegetation, as verified by the Landscape Architect.

4. Following final application, mow dead vegetation to 2 inches or less and remove clippings.

B. Disturbed Areas and Areas Where Topsoil Has Been Removed:

1. Restore topsoil and finish grades as specified in Section 329115 "Soil Preparation (Performance Specification)" and as indicated on the Drawings.
2. Following final grading, allow weed seedlings to germinate and reach 2 to 4 inches in height. Treat with glyphosate herbicide as specified above. Repeat until germination of weed seedlings has substantially ceased, as verified by the Landscape Architect.

C. All Areas: Do not till or disc after final herbicide application. Limit soil disturbance to what is needed for seed-to-soil contact, to avoid bringing dormant weed seed to the surface.

3.4 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil in accordance with Section 329115 "Soil Preparation (Performance Specification)."

B. Placing Planting Soil: Blend planting soil in place.

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate in accordance with manufacturer's written instructions.

3.5 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped, container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of root ball, measured from the root flare to the bottom of root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to correct level and thoroughly tamp the added soil to prevent settling.

6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.
8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.6 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball in accordance with ANSI Z60.1. If root flare is not visible, remove soil in a level manner from root ball to where the top-most root emerges from the trunk. After soil removal to expose root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)." For trees, use excavated soil for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.

    a. Quantity: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final

layer of soil.

D. Balled and Potted, and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as specified in Section 329115 "Soil Preparation (Performance Specification)." For trees, use excavated soil for backfill.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of root ball.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.

B. Prune, thin, and shape trees, shrubs, and vines in accordance with standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

C. Do not apply pruning paint to wounds.

3.8 INSTALLATION OF TREE-WATERING DEVICES

A. A. Install one tree-watering device at each new tree immediately after planting and mulching, in accordance with manufacturer's written instructions. Install bags of the type indicated in Part 2 per the tree form.

B. Fill bags at installation and refill as required to maintain root ball moisture, but not less than once per week during the growing season when rainfall is less than 1 inch per week.

3.9 INSTALLATION OF TREE-STABILIZATION MATERIALS

A. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by root ball unless otherwise indicated.

1. Proprietary Root-Ball Stabilization Device: Install root-ball stabilization system sized and positioned as recommended by manufacturer unless otherwise indicated and in accordance with manufacturer's written instructions.

3.10 INSTALLATION OF ROOT BARRIER

A. Install root barrier where trees are planted within 60 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

B. Align root barrier with bottom edge angled at 20 degrees away from the paving or other hardscape element, and run it linearly along and adjacent to paving or other hardscape elements to be protected from invasive roots.

3.11 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use planting soil for backfill, as specified in Section 329115 "Soil Preparation (Performance Specification)."

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.12 SEEDING

A. Broadcast seed in two passes at right angles, half the quantity per pass. Mix fine seed with an inert carrier, such as sand or sawdust, for uniform distribution. Roll or cultipack to ensure seed-to-soil contact. Do not bury seed deeper than 1/4 inch.

B. Apply seeded area mulch lightly, with approximately 50 percent of the soil surface visible, or omit as directed by the Landscape Architect.

3.13 INSTALLATION OF MULCHES

A. Install weed-control barriers before mulching in accordance with manufacturer's written instructions. Completely cover area to be mulched, overlapping edges minimum of 12 inches, and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of average thickness, with radius around trunks or stems. Do not create a mulch cone or place mulch within of trunks or stems.

C. Fibar Engineered Mulch:

1. Excavate area 8" (for 8" installation) or 12" deep (for 12" installation) with a 1% downward grade to ensure proper drainage to FibarDrain Drain Strip. It is not recommended that a Fibar System be installed on a grade greater than 10%. All roots, stones, and vegetation must be removed.
2. The area should be well-compacted and accurately graded, especially in areas where additional fill has been brought in.
3. Cut a trench 2"wide by 6" deep all along the inside edge perpendicular to the grade and install FibarDrain Drain Strip. Connect low end of FibarDrain Drain Strip to storm drain or similar device to take water collected from playground away from site.
4. Cover sub-grade with FibarFelt 100% non-woven geotextile. Overlap all seams 3".
5. Spread Fibar®Engineered Wood Fiber using a Bobcat or small front-end loader. Operator should be careful not to travel on the FibarFelt. Geotextile or turn sharply on the wood fiber. It will also be necessary to use hand labor to spread. To allow for natural compaction, we supply additional wood fiber. Important: Install all the Fibar Engineered Wood Fiber delivered. The fiber will be several inches above grade or border until it compacts. Feather the edges to make a smooth transition to existing grade or border.
6. Hand-rake for a smooth & level finished surface. Natural compaction will occur over time and is dependent on the amount of playground use and environmental conditions.
7. After two weeks of active use, surface should be raked level again

3.14 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils

free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

D. Watering: Water plantings and seeded areas as required under Article 1.11. Refill tree-watering devices as required in Part 3. Inspect devices monthly for damage, leaks, and girdling or abrasion of bark, and replace or adjust as necessary. Empty tree-watering devices before the onset of freezing weather and reinstall at the start of the following growing season.

3.15 SEED ESTABLISHMENT MAINTENANCE AND ACCEPTANCE

A. Establishment Mowing: During the first growing season, mow seeded areas to a height of 6 to 8 inches whenever growth reaches 12 to 18 inches, to control annual weeds and admit light to seedlings. Do not mow lower than 6 inches.

B. Weed Control: Hand-pull or spot-treat invasive and noxious species. Do not use broadleaf-selective herbicides in seeded areas.

C. Watering: Do not water seeded areas on a routine schedule. Provide supplemental water under Article 1.11 only as follows:

1. During Germination and Early Establishment: When less than 1 inch of rainfall occurs over any 14-day period during the first 8 weeks following seeding, apply water to moisten the soil to a depth of approximately 2 inches without causing runoff, ponding, or seed displacement.
2. After Early Establishment: Provide supplemental water only during extended drought, as directed by the Landscape Architect. Apply deeply and infrequently.
3. Requirements of this paragraph govern over general watering requirements of Article 1.11 for riparian upland seed mix areas.

D. Overseeding

a. Prior to the start of the second growing season following seeding, and within the maintenance period, overseed thin or sparse areas with reserve seed as directed by the Landscape Architect. Broadcast in accordance with seeding requirements of this Section. Turn over any unused reserve seed to Owner at the end of the maintenance period, with seed tags and storage instructions.
b. Overseeding with reserve seed does not relieve Contractor of reseeding obligations under the acceptance criteria. Areas failing acceptance criteria shall be reseeded with additional seed furnished by Contractor at no additional cost to Owner.

E. Acceptance Criteria:

1. At the end of the maintenance period, seeded areas shall meet the following, as verified by the Landscape Architect:

a. No bare areas larger than 2 SF.
b. Average density of not less than 5 seedlings of specified species per SF, measured in not fewer than 10 randomly located 1-SF sample plots.
c. Not fewer than 8 of the 14 specified species present, including not fewer than 2 grass species.
d. Invasive and noxious species not exceeding 10 percent cover.

2. Reseed areas not meeting acceptance criteria at no additional cost to Owner. Reseeded areas are subject to a maintenance period extended through the following growing season.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Perform tree pit percolation tests.
2. Tree pit construction will be considered defective if it does not pass percolation tests and inspections.
3. Do not proceed with planting in tree pits until satisfactory percolation is demonstrated.

C. Prepare test and inspection reports.

3.17 REPAIR AND REPLACEMENT

A. Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in unhealthy condition before end of corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Species of Replacement Trees: Species selected by Landscape Architect.

3.18 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices. At the end of the maintenance period, remove tree-watering devices unless otherwise directed by the Landscape Architect.

END OF SECTION 32 93 00

SECTION 32 98 00 – FOUNTAIN

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. Provide and furnish all design, labor, incidental materials, equipment, controls, testing, start-up, commissioning, and services necessary for a complete, safe, operational, and maintainable decorative water feature indicated on the Drawings. Work includes:
      a. Chamber basin to collect and recirculate water.
      b. Limestone fascia to water feature.
      c. Structural construction of water feature.
      d. Coordination of fountain waterproofing interfaces and penetrations.
      e. Decorative tile finishes.
      f. Stone coping.
      g. Spouting sculptures.
      h. Connection to stormwater piping where indicated.
      i. Recirculation water supply piping, submersible pump, valves, drains, skimmers, and water treatment system.
      j. Equipment, controls, electrical connections, and power for water feature.
      k. Testing, commissioning, Owner instruction, and closeout documentation.
   2. Provide a minimum three-year warranty period as specified herein.

1.3 RELATED WORK

A. Coordinate installation and fitting with work of other trades:
   1. Section 32 32 19 – Garden Wall.
   2. Section 32 14 00 – Unit Paving.
   3. Section 32 33 00 – Site Furnishings.
   4. Section 32 93 00 – Plants.

B. Coordinate dimensions, elevations, embedded items, sleeves, penetrations, electrical requirements, drainage, waterproofing, and finish interfaces with related Sections and Drawings.

1.4 DEFINITIONS

A. Water Feature Contractor: Contractor or specialty subcontractor responsible for complete fountain system installation, including mechanical components, piping, equipment, controls, testing, and coordination of interfaces.

B. Operating Water Level: Water elevation established by the fountain overflow, skimmer, or other level-control component and indicated on the approved shop drawings.

C. Substantial Completion of Fountain: Point at which the fountain is fully assembled, finish work is complete, equipment is operational, circulation and treatment systems are functioning, and required testing has been successfully completed.

1.5 SUBMITTALS

A. Contractor Qualifications. Minimum of 5 projects of similar type and scale and minimum of 5 years of experience.

B. Installer Qualifications. Submit a minimum of 3 examples of highly detailed water features for commercial, residential, or institutional clients, including fountain and associated mechanical systems. Each example shall be a minimum of $50,000 budget and shall include photographs or drawings, final cost, date of completion, Owner reference, and contact information.

C. Contractor provides complete design drawings and shop drawings through General Contractor. Shop Drawings shall show full detail including:
   a. Plan, sections, dimensions, elevations, basin geometry, operating water level, and finish interfaces.
   b. Mechanical connections, pipe sizes, valves, drains, skimmers, overflow, pump, treatment equipment, and maintenance access.
   c. Flow specifications for all components and hydraulic calculations indicating design flow, total dynamic head, and pump selection.
   d. Electrical connections, controls, disconnects, motor data, wiring diagrams, and control sequence.
   e. Sleeves, penetrations, anchors, supports, and coordination with structural and waterproofing work.

D. Manufacturer’s specifications and product data for each type of fountain component, equipment, finish material, and accessory.

E. Submit water-treatment equipment data, operating requirements, dosing requirements, maintenance requirements, and safety provisions.

F. Submit one sample, minimum 3 inch x 3 inch, of each material for Landscape Architect’s review and approval prior to delivery to site:
   1. Limestone fascia.
   2. Limestone cap.
   3. Vertical wall tile.
   4. Sample mosaic by Artist.
   5. Skimmers and visible drains.

G. Submit full-size or appropriately scaled mosaic shop drawing and color rendering for review by Landscape Architect and Artist. Coordinate final mosaic dimensions and installation sequence with waterproofing and fountain construction.

H. Submit operation and maintenance manuals, final as-built drawings, equipment schedules, warranty documentation, testing reports, and Owner training documentation at closeout.

1.6 QUALITY ASSURANCE

A. Codes and Standards. In addition to complying with all pertinent codes and regulations, comply with the latest adopted rules of the National Electrical Code and applicable local amendments for all electrical work and materials.

B. Installer shall specialize in water features and associated mechanical systems and shall employ personnel experienced with the type of work required.

C. Provide at least one person who shall be present during execution of this portion of the Work, shall be thoroughly familiar with the materials and equipment being installed, and shall direct all work performed under this Section.

D. Install manufactured equipment in accordance with published manufacturer's recommendations except where more stringent requirements are specified herein.

E. Where requested by Landscape Architect, provide a representative mockup of visible fountain finish interfaces, including stone, tile, grout, sealant, coping, and mosaic.

1.7 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid all possible damage. Hand excavate, as required. Repair damage to utility owner's satisfaction at no additional cost.

B. Site Inspection: Examine conditions under which Work is to be performed and notify Landscape Architect in writing of unsatisfactory conditions. Do not perform Work until conditions are satisfactory and acceptable.

C. Protection: Protect the Work, adjacent construction, existing utilities, finishes, landscaping, and the general public.

D. Installer shall coordinate with other trades for proper installation of embedded items, sleeves, conduits, piping, anchors, supports, drainage, and waterproofing interfaces.

E. Protect materials and installed Work from freezing, excessive moisture, precipitation, construction traffic, and other conditions that could impair installation or performance.

1.8 WARRANTY

A. Fountains shall be warranted against defects in materials and workmanship for a minimum of three years from date of Substantial Completion.

B. Warranty shall include labor and materials necessary to correct defects attributable to the Work.

C. Manufacturer warranties for individual components shall be in addition to, and shall not limit, the Contractor's system warranty.

D. Warranty shall include correction of leaks, pump or circulation failures, defective valves or controls, and defective installation of fountain components, except where damage is caused by Owner abuse, vandalism, or conditions specifically excluded in the Contract.

PART 2 - PRODUCTS

2.1 GENERAL

A. Furnish and install components in the size, shape, materials, finishes, and quantities indicated on the Drawings. System design, components, and installation shall meet all applicable federal, state, and city codes.

B. Contractor is required to obtain all permits necessary to complete the Work.

C. Provide equipment access and service clearances necessary for safe inspection, cleaning, repair, and replacement.

D. Provide corrosion-resistant components appropriate for continuous outdoor service and exposure to treated water.

2.2 FOUNTAIN BASIN AND STRUCTURAL COMPONENTS

A. Basin: Construct basin and chamber as indicated on Drawings. Provide structural construction suitable to support water loads, finish materials, equipment, and adjacent construction.

B. Basin surfaces shall be sound, clean, properly cured, and suitable to receive specified waterproofing and finish systems.

C. Provide sleeves, blockouts, embedded items, anchors, and penetrations required for complete installation.

D. Coordinate all penetrations with waterproofing system requirements. Do not field-drill or core through completed waterproofing without approved repair procedures.

2.3 VESSEL FASCIA

A. Limestone.
   1. Size: per Drawings.
   2. Color: Cottonwood, or approved match to unit paving.
   3. Pattern: Egg and dart as shown on Drawings.
   4. Provide sound, durable stone free from cracks, spalls, or defects that impair appearance or performance.

2.4 POOL COPING

A. Limestone.
   1. Size: per Drawings.

2. Color: Cottonwood, or approved match to unit paving.
3. Provide coping with uniform appearance, consistent joints, and positive drainage away from finished fountain surfaces where indicated.

2.5 POOL VERTICAL WALL TILE

A. Size: 2 inch by 8 inch.

B. Type: Brickart Glazed Porcelain Tile.

C. Vendor: Tilefly, www.tilefly.com.

D. Color: Sage, or as approved by Landscape Architect from manufacturer's complete range.

E. Provide setting materials, grout, movement joints, and installation accessories compatible with continuous wet-service exterior conditions and the approved waterproofing system.

2.6 MOSAIC

A. Decorative custom mosaic art piece applied per Drawings and discussion with Landscape Architect and Artist.

B. Mosaic materials and setting system shall be suitable for continuous wet-service exposure.

C. Coordinate substrate preparation, waterproofing, setting materials, grout, sealants, and transitions to prevent water intrusion behind the mosaic.

D. Provide a complete finished mosaic installation to the satisfaction of Landscape Architect and Owner, without exposed sharp edges or projections.

2.7 FROG SCULPTURES, WATER SPOUT

A. Quantity: 4.

B. Size: 4 1/2 inch by 6 1/2 inch by 7 1/2 inch.

C. Material: Natural Lead.

D. Vendor: Kenneth Lynch & Sons, www.klynchandsons.com/spouting-frog/.

E. Provide secure attachment, piping connection, and sealing method appropriate to the sculpture and fountain construction.

F. Coordinate final spout elevation, orientation, and flow with hydraulic calculations and approved shop drawings.

2.8 RECIRCULATION SYSTEM

A. Provide a complete recirculation system sized for the required flow and turnover indicated by approved hydraulic calculations.

B. Pump: Submersible pump or approved pump configuration indicated by the approved shop drawings. Provide pump selected for continuous duty at required flow and total dynamic head.

C. Provide pump with manufacturer’s recommended inlet protection, strainer, and service access.

D. Piping: Provide piping, fittings, valves, unions, supports, and accessories suitable for fountain service and compatible with water-treatment conditions.

E. Provide isolation valves and unions necessary to permit removal and maintenance of pumps and major equipment without draining the entire fountain where practical.

F. Provide overflow, drain, make-up water, and recirculation connections as indicated on Drawings.

2.9 WATER TREATMENT

A. Provide complete water-treatment system appropriate for fountain volume, operating conditions, and applicable health and safety requirements.

B. Treatment equipment shall include all pumps, feeders, sensors, controls, valves, fittings, and accessories required for a complete operating system.

C. Provide means of maintaining water quality and controlling algae, scale, and other conditions that could impair appearance or equipment operation.

2.10 SKIMMERS, DRAINS, OVERFLOW, AND FITTINGS

A. Provide skimmers, drains, strainers, overflow fittings, visible drains, grates, covers, and fittings as indicated on Drawings.

B. Visible components shall be corrosion-resistant and coordinated with adjacent finishes.

C. Provide removable components necessary for routine cleaning and maintenance.

D. Provide drain and overflow capacity adequate for anticipated operating conditions.

2.11 CONTROLS AND ELECTRICAL

A. Provide controls, timers, switches, disconnects, motor controls, wiring, and accessories required for a complete operating fountain system.

B. Coordinate electrical service, grounding, bonding, GFCI protection, disconnects, and equipment locations with Electrical Contractor and applicable codes.

C. Provide control logic and operating sequence on shop drawings.

D. Locate controls and electrical components in accessible, protected locations.

E. All equipment shall be properly grounded and bonded as required by applicable codes.

F. Coordinate exact equipment locations with Landscape Architect and Mechanical Engineer in field and according to Drawings prior to any utility installation.

2.12 SEALANTS AND WATERPROOFING INTERFACES

A. Provide sealants, gaskets, penetrations, sleeves, and accessory materials compatible with the fountain waterproofing and finish systems.

B. Coordinate waterproofing system with the party responsible for structural waterproofing. Fountain Contractor shall be responsible for complete and watertight installation of fountain-system penetrations and accessories within their scope.

C. Do not use materials incompatible with the approved waterproofing membrane, tile setting materials, stone, grout, sealants, or water-treatment system.

2.13 ANCHORS AND FASTENERS

A. Provide corrosion-resistant anchors, fasteners, brackets, supports, and accessories required for secure installation.

B. Provide stainless steel or other approved corrosion-resistant materials suitable for wet and exterior conditions.

2.14 WALL

A. Seat wall and stone cladding are by other subcontractors of the GC. Fountain Contractor is responsible for installation of all piping, conduit, and accessories required for complete installation of fountains and securely fastening fountain to seat wall, including coordination of installation with other trades. Refer to Section 32 32 19.

PART 3 - EXECUTION

3.1 GENERAL

A. Stake out location indicated for approval by the Landscape Architect prior to beginning installation.

B. Verify dimensions, elevations, substrates, adjacent construction, utility locations, and readiness of surfaces before beginning installation.

C. Install items according to approved shop drawings, manufacturer’s recommendations, and applicable codes.

D. Provide and install all necessary anchors, fasteners, sleeves, fittings, supports, and accessories.

E. Coordinate installation and fitting with the work of other trades.

3.2 WATERPROOFING AND FINISH COORDINATION

A. Coordinate all fountain penetrations and embedded components with waterproofing installation.

B. Provide compatible sealants, gaskets, sleeves, and termination details required for watertight installation.

C. Do not conceal fountain penetrations, piping, or waterproofing interfaces until required inspections and testing have been completed.

D. Repair damage to waterproofing caused by Work of this Section using approved compatible materials and methods.

3.3 PIPING AND HYDRAULIC TESTING

A. Test piping systems before concealment and before final operation.

B. Test piping in accordance with applicable code and manufacturer requirements, but not less than the pressure and duration recommended for the installed piping system.

C. Inspect all joints, valves, penetrations, and connections for leakage.

D. Repair leaks and retest until the system passes.

3.4 TESTING

A. Notify the Landscape Architect in writing when testing will be conducted. Conduct tests in presence of Landscape Architect, Architect, and Facilities Manager when requested.

B. Fill fountain to operating level and perform a minimum 24-hour water-retention observation before final acceptance, unless a longer period is required by the Contract Documents.

C. During testing, verify water-retention performance, overflow operation, drains, skimmers, pump operation, circulation, spout performance, water levels, controls, and treatment equipment.

D. No unexplained loss of water or leakage attributable to the Work will be accepted.

E. Correct deficiencies and repeat testing at no additional cost to Owner.

3.5 SYSTEM COMMISSIONING

A. Commission the complete fountain system after installation and successful water-retention testing.

B. Verify pump flow, water circulation, water levels, spout performance, treatment operation, controls, timers, valves, and safety devices.

C. Balance individual spouts and outlets to provide the appearance indicated on the Drawings.

D. Verify that pump operation does not produce excessive vibration, noise, cavitation, or objectionable turbulence.

E. Record final operating settings and equipment information for inclusion in closeout documents.

3.6 CLEAN UP AND PROTECTION

A. Remove construction debris, excess grout, mortar, sealant, protective films, labels, and other materials from fountain surfaces and equipment.

B. Clean limestone, tile, mosaic, coping, grates, sculptures, and visible fittings using methods and products recommended by manufacturers.

C. Protect installed product until completion of project.

D. Touch up, repair or replace damaged products.

E. Do not operate the fountain for extended periods before final commissioning unless approved by Landscape Architect.

3.7 OWNER TRAINING

A. Instruct Owner and Facility Manager in operation, shutdown, seasonal operation, cleaning, water treatment, routine maintenance, winterization, troubleshooting, and emergency procedures.

B. Training shall occur after commissioning and before final acceptance.

C. Provide written operating and maintenance instructions as part of closeout documentation.

3.8 CLOSEOUT DOCUMENTATION

A. Submit final as-built drawings showing actual installed equipment, piping routes, valves, drains, skimmers, electrical connections, controls, and equipment locations.

B. Submit final equipment schedule identifying manufacturer, model, serial number, motor horsepower, voltage, and replacement information.

C. Submit final hydraulic and control settings.

D. Submit warranty certificates and manufacturer documentation.

E. Submit water-treatment operating and maintenance procedures.

F. Fountain shall be considered complete only when all components are installed, tested, commissioned, cleaned, operational, and accepted by Owner.

END OF SECTION 32 98 00

SECTION 33 41 00
STORM SEWER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Site storm sewer drainage piping, fittings, accessories, and bedding.

B. Connection of site and/or building storm water drainage system to municipal storm sewers.

1.2 RELATED REQUIREMENTS

A. Section 31 23 33 - Excavation, Backfill, and Compaction for Utilities

B. Section 33 44 00 – Storm Drainage Structures

C. Local governing authority and code requirements

D. Construction Drawings

1.3 PUBLIC WORK

A. Comply with the City of Bentonville's standard storm sewer specifications for public storm sewer lines. If a conflict is found between this section and city standards for public utilities, city standards shall be the priority. It shall be the Contractor's responsibility to obtain city standard water and sewer specifications and comply with the minimum requirements.

1.4 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO) latest edition
   - M 36 Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains
   - M 198 Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
   - M 252 Corrugated Polyethylene Drainage Tubing
   - M 274 Pure Aluminum Type 2 Coated Corrugated Steel Culverts and Uderdrains
   - M 294 Polyvinyl Chloride (PVC) Pipe and Fittings

B. American Society for Testing and Materials (ASTM) latest edition
   - A 760 Spiral Rib Metal Pipe (Type 1 R)
   - C 14 Concrete Sewer, Storm Drain, and Culvert Pipe
   - C 76 Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
   - C 443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
   - D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe

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D 3034 Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
F 794 Polyvinyl Chloride (PVC) Pipe and Fittings

1.5 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified local requirements.

1.6 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.

1.7 PROJECT CONDITIONS

A. Coordinate work with storm sewer connections to structures and to municipal storm sewer system.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS AND ACCESSORIES

A. Reinforced Concrete Pipe: Comply with requirements of ASTM C 76, Class III unless another class type is indicated on Construction Drawings, installed with flexible plastic, bitumen gaskets at joints. Gaskets shall comply with AASHTO M 198 75I, Type B, and shall be installed in strict accordance with pipe manufacturer's recommendations.

B. High Density Polyethylene (HDPE): Only permitted when specifically indicated on Construction Drawings and shall conform with AASHTO Designation M 252. Pipe must be installed in accordance with the pipe manufacturer's installation Guidelines for Culvert Storm Drainage Applications. Both Perforated and Nonperforated pipes are used; ensure correct manufacturer's guidelines are used for each type. Pipe types are called out in the construction plans. Acceptable manufacturers: Advanced Drainage Systems, Inc. "ADS N-12", or approved equivalent.

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2.2 INLETS, CATCH BASINS AND JUNCTION BOXES

A. Lid and frame per details shown on Construction Drawings.

B. Structure construction shall be in accordance with details shown on Construction Drawings and in accordance with Section 33 44 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items specified in other sections are properly sized and located.

B. Verify that trench cut and excavation is ready to receive work and excavations, dimensions, and elevations are as indicated on Construction Drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with bedding material.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

C. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.

3.3 BEDDING

A. Excavate pipe trench and place bedding material in accordance with Section 31 23 33.

3.4 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C 14, ASTM D 2321, or manufacturer's instructions and state or local requirements.

B. Install pipe on bedding in accordance with Section 31 23 33.

C. Lay pipe to slope gradients noted on Construction Drawings.

D. Refer to Section 31 23 33 for trenching requirements. Do not displace or damage pipe when backfilling and compacting.

3.5 INSTALLATION - CATCH BASINS, INLETS, AND JUNCTION BOXES

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A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad in accordance with section 03 30 00, with provision for storm sewer pipe to be placed at proper elevation.

C. Form and place cast-in-place concrete walls, sleeved at proper elevation to receive storm sewer pipe in accordance with section 03 30 00 and details shown on Construction Drawings.

D. Form and place cast-in-place top of structure in accordance with details shown on Construction Drawings.

END OF SECTION

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