ARKANSAS SCHOOL FOR MATH, SCIENCES, + THE ARTS

ASMSA Alumni Hall & New Charter Field
Project Manual

28 August 2026





DOMAIN ARCHITECTURE

11130 Industriplex Blvd, Suite 200 | Baton Rouge, LA 70809
3200 SW Regency Parkway, Suite 4 | Bentonville, AR 72712
LA: 225.216.3770 **AR:** 479.255.5879 | **www.domainbr.com**

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PART 1 - GENERAL



1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

1. Michael K. Buturla, Domain Architecture, APAC
2. License # 10216
3. Responsible for Divisions 01-49 Sections except where indicated as prepared by other design professionals of record.

B. Civil Engineer:



8/20/2026

1. Alan Taylor, PE, Wallace Design Collective
2. License 23870
3. Responsible for Sections 311000, 312000, 321216, 321313, 321373, 331100, 333100,334100

C. Landscape Architect:



08.28.2026

1. Fallon Henry, PLA, Wallace Design Collective
2. License 712033
3. Responsible for Sections 015639, 329200, 329223

D. Structural Engineer:



1. Dan Mazzei, PE, Wallace Design Colectiva
2. License 20159
3. Responsible for Sections 031000, 032000, 033000, 051200, 521000, 053100, 054000, 312001

E. HVAC Engineer & Plumbing

1. Jared C. Watson, Prigm Engineering, PLLC
2. License #15926
3. Responsible for Divisions 22 and 23.

F. Electrical Engineer:



1. Daniel E. Miles, Prigm Engineering, PLLC
2. License #14710
3. Responsible for Division 26 and 27 and Section 284600.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 00 01 07

UNIFORM SURETY BOND FORM

STATE OF ARKANSAS

SECURITIES DEPARTMENT
LITTLE ROCK, ARKANSAS

Bond No. _____

KNOW ALL PERSONS BY THESE PRESENTS:

That, _____
(name and address of broker-dealer, investment adviser, or agent of the issuer)

as Principal, having filed with the office of the Arkansas Securities Department ("Department")

on or about the _____ day of _____, 20____, an application to transact business in

the State of Arkansas as a _____ and
(designate whether principal is a broker-dealer, investment adviser, or agent of the issuer)

_____ as Surety, a corporation
(name and address of Surety)
organized under the laws of the State/Commonwealth/Territory of _____ and being duly authorized to transact the business of indemnity and surety in this State, do hereby acknowledge our indebtedness to any person having a claim pursuant to a cause of action brought against the Principal under the Arkansas Securities Act [Ark. Code Ann. § 23-42-101 et seq.]("Act"). As required by the Act and Rules of the Arkansas Securities Commissioner ("Rules"), this surety bond ("Bond") is in the amount of _____ dollars ($_____), and provides that the aggregate liability hereunder to all persons shall not exceed the amount specified for the bond, regardless of the number of claimants, and shall not be construed as individual liability.

Liability for the payment of the amount to which we hereby obligate and bond ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, becomes effective upon the following conditions:

1. Registration of the Principal to transact business in the State of Arkansas as a _____.
(broker-dealer, investment adviser, or agent of the issuer)
2. Failure by the Principal to strictly comply with all applicable provisions of the Act and Rules.

This Bond shall expire at such time as the registration of the Principal is withdrawn, terminates through non-renewal, or is revoked by the Arkansas Securities Commissioner, except as to liability for acts or omissions which occur prior to such time. This Bond may also be cancelled by the Surety upon sixty days prior written notice by registered mail to the Principal and to the

Arkansas Securities Department ("Department"), in which case this Bond shall be considered cancelled upon the expiration of said sixty day period, except as to liability for acts or omissions which occur prior to the date of cancellation. Notice shall be deemed effective upon the receipt by the Department of said written notice along with sufficient proof of notice to the Principal.

No suit may be maintained to enforce any liability arising under this Bond unless brought within five years after the act or omission upon which jurisdiction is established against the Principal and/or the Surety upon this Bond.

It is understood and agreed that any person(s) having a claim under the conditions of this obligation may initiate suit in any court of competent jurisdiction against the Principal and/or the Surety upon this Bond.

WITNESS OUR SIGNATURES, this _____ day of _____, 20_____.

_____
Principal

_____
By

_____
Surety

_____
By

ACKNOWLEDGMENT

STATE OF _____)

COUNTY OF _____)

On this _____ day of _____, 20___, before me personally appeared

_____, to me known to be the person described herein and
(Authorized Representative of Principal)
who executed the foregoing instrument, as the authorized representative of the Principal and

acknowledged to me that he executed the same.

(NOTARY SEAL)

_____
Notary Public,

County, _____

My commission expires _____

Owner-Contractor Agreement

American Institute for Architects, AIA Document A101, 2007 edition, Standard Form of Agreement between Owner & Contractor, is included in this project by reference.

Copies of this document are available, upon request, for review at the Architect's office.

Performance Bond, and Labor and Material Payment Bond

American Institute for Architects, AIA Document A312, 2010 edition, Performance Bond, and Labor and Material Payment Bond, is included in this project by reference.

Obtain this copyrighted form by purchasing from AIA Louisiana office (tel. 225-387-5579). Or other agencies authorized to issue this form.

Complete and submit this form in accordance with Instructions to Bidders, Article 7.

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

Arkansas School for Mathematics, Sciences, & the Arts
Alumni Lane
Hot Springs, Arkansas 71901

THE OWNER:
(Name, legal status and address)

Arkansas School for Mathematics, Sciences, & the Arts
200 Whittington Ave
Hot Springs, Arkansas 71901

THE ARCHITECT:
(Name, legal status and address)

Domain Architecture, APAC
3200 SW Regency Parkway, Suite 4
Bentonville, Arkansas 72712

ADDITIONS AND DELETIONS:
The author of this document may have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added to or deleted from the original AIA text.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon written protocols governing the transmission and use of, and reliance on, Instruments of Service or any other information or documentation in digital form.

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§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to written protocols governing the use of, and reliance on, the information contained in the model shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

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assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

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§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required

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for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to

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completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

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

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

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§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

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

§ 4.2.4 Communications

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

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

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

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

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

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

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assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

§ 5.4 Contingent Assignment of Subcontracts

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

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

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with

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any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

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

§ 6.2 Mutual Responsibility

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

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

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

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§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

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

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

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

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

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

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims,

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security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

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

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

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

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

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make

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payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

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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.

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and

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belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

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

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

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

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

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

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.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or

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entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by

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

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring

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the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

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

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor

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shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

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

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

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

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

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

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

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

§ 14.3 Suspension by the Owner for Convenience

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

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

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.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

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

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

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

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

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

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

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

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

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§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

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AIA® Document A201® – 2017

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PAGE 1:

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Domain Architecture, APAC

3200 SW Regency Parkway, Suite 4
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_____

(Signed)

_____

(Title)

_____

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UNIT PRICE FORM

TO: Arkansas School for Mathematics, Sciences, & the Arts

BID FOR:
ASMSA Alumni Hall & New Charter Field

UNIT PRICES: This form shall be used for any and all work required by the Bidding Documents and described as unit prices. Amounts shall be stated in figures and only in figures.

DESCRIPTION:	✠ Base Bid or ❑ Alt.# ____ Unit Price Extension amount is ***included*** in Base Bid. Provide rough-ins for Owner's CCTV cameras, including electrical power, junction box(es), wiring, data wiring and connection to panels / service. Unit price should contain all work required to provide power and data ready for the Owner's 3rd party provider to connect and install devices.			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*
Unit Price #1	13	EA		

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___ Unit Price Extension amount is *included* in Base Bid.			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*
- n/a -	- n/a -	- n/a -	- n/a -	- n/a -

DESCRIPTION:	❑ Base Bid or ❑ Alt.# ___ Unit Price Extension amount is *included* in Base Bid.			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*
- n/a -	- n/a -	- n/a -	- n/a -	- n/a -

DESCRIPTION:	❑ Base Bid or Alt.# __			
REF. NO.	QUANTITY:	UNIT OF MEASURE:	UNIT PRICE	UNIT PRICE EXTENSION *(Quantity times Unit Price)*
- n/a -	- n/a -	- n/a -	- n/a -	- n/a -

Quantities are estimated. The contractor will be paid based upon actual quantities as verified by the Owner.

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work performed by Owner.
4. Contractor's use of site and premises.
5. Coordination with occupants.
6. Work restrictions.
7. Specification and Drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification:

Arkansas School for Mathematics Sciences & the Arts Alumni Hall & New Charter Field
TBD Alumni Lane
Hot Springs, AR 71901

B. Owner:

Arkansas School for Mathematics, Sciences & the Arts
200 Whittington Ave
Hot Springs, AR 71901

C. Architect:

Domain Architecture, APAC
3200 SW Regency Pkwy, Ste 4
Bentonville, AR 72712

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Improvements to the Charter Field Site include paving, canopy, lighting and landscaping.
2. New student wellness facility, including multipurpose rooms, gym facility, Esports lab, and supporting spaces

3. And other Work indicated in the Contract Documents

B. Type of Contract:

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

1.4 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet beyond building perimeter; 15 feet beyond surface walkways, patios, surface parking, and utilities; and 25 feet beyond constructed areas with permeable surfaces that require additional staging areas to limit compaction in the constructed areas.
2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: Owner will occupy Project site and adjacent building(s) during entire construction period. Cooperate with Owner during construction operations to

minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to between 7:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: To be clarified with Owner at Pre-Construction Meeting.
2. Early Morning Hours: < To be clarified with Owner at Pre-Construction Meeting.
3. Hours for Utility Shutdowns: To be clarified with Owner at Pre-Construction Meeting.
4. Hours for noisy activities: To be clarified with Owner at Pre-Construction Meeting

C. On-Site Work Day Restrictions: Do not perform work resulting in utility shutdowns or resulting in noisy activity on-site during work black-out days. Owner will provide schedule of black-out days for contractors use.

D. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

E. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

F. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

H. Employee Screening: Comply with Owner's requirements for screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.8 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 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

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

D. 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 scheduled on Drawings and published as part of the U.S. National CAD Standard.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. Unit price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, labor and equipment, including costs for delivery, installation, insurance, applicable taxes, equipment rental, overhead, and profit, for entire installation in place.

B. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

1.4 MEASUREMENT AND PAYMENT

A. Subject to the actual quantity of material replaced for the entire project, the Owner intends to execute a Change Order for the amount of the quantity actually used. The Owner will execute a credit for the balance of the quantity not used, or will increase corresponding amount if quantity is exceeded.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

C. The Unit Price Amount will be prorated on a cost per unit basis based on the computation below in determining the final amount of the Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE / LIST OF UNIT PRICES

A. Unit Price No. 1: Provide rough-ins for Owner’s CCTV cameras, including electrical power, junction box(es), wiring, data wiring, and connections to panel / service. Unit price should contain all work required to provide power and data ready for the Owner’s 3rd-party provide to connect and install devices.
   1. Quantity: As indicated in Unit Price Bid Form.

2. Bidder shall figure Unit Price, Value Amount and include in the Base Bid for this Unit Price.
3. Show Value Amount in Schedule of Values.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
   1. The cost for each alternate is the net addition to the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
   2. Do not include bid amounts for indicated Alternate Bid items in Base Bid.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work to completely integrate work of the alternate into Project.
   1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A Schedule of Alternates is included below.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Addition of a generator and related transfer switch(es).

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 -GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

1.3 DEFINITIONS

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

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms. Substitutions for Cause are not allowed after the bid opening without approval for the Owner. The Owner will have authority in all instances.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.

h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICCES if applicable.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 -PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Substitutions for Cause are not allowed after the bid opening without approval for the Owner. The Owner will have authority in all instances. Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

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

    a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 -EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for:-
   1. Minor changes in the Work
   2. Construction Change Directives
   3. Change Orders

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustments to the Contract Sum or the Contract Time.

1.3 PROPOSAL REQUESTS

A. Proposal Requests may be:
   1. Owner-Initiated: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. The description may include supplemental or revised Drawings and Specifications.
   2. Contractor-Initiated: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

B. Proposal Requests issued do not constitute stopping work in progress, or authorization to execute the proposed change.

1.4 PROPOSALS

A. Submit proposal using the Proposal Summary and Worksheets forms attached to this specifications section, estimating cost adjustments to the Contract Sum and the Contract Time to execute the change.
   1. In the Summary sheet include a statement outlining reasons for the change and the effect of the change on the Work. Provide a description of the proposed change.
   2. Worksheets: Include separate Worksheets for work performed by the Contractor, and each sub-contractor corresponding with each type of proposal request.
      a. Include lists of quantities of products required, or eliminated costs, with total amount of purchases and credits to be made.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and foreman directly attributable to the change.
   3. Breakdown Comment Sheet: Upon request and as Contractor deems necessary, use the Breakdown Comment sheet to describe and explain material, labor and equipment in preceding Worksheet.
   4. Where changes affect Contract Time, include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. The following are not chargeable in change order proposals:
   1. Costs for Superintendent.
   2. Truck charges for superintendent, foremen, and workers.
   3. General requirements, overhead and profit for weather-related time extensions.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of the Contractor's Proposal Request, a Change Order will be issued for signatures of the Architect, Owner and Contractor .

B. After a Change Order is executed, Contractor may include Change Order amount as line item in subsequent Payment Applications.

1.7 CONSTRUCTION CHANGE DIRECTIVES

A. Construction Change Directives: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

B. Proposals: Submit proposals as described in Article 1.4 - Proposals above.

C. Upon acceptance by Owner and issuance an executed Construction Change Directive, Contractor is authorized and directed by Owner to proceed with the Work.

D. Documentation: Where applicable, maintain detailed records on a time and material basis of work required by Construction Change Directives.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

E. Contractor may not include Construction Change Directives in Payment Applications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

Attachment
Change Order Proposal Summary and Worksheets

Construction Contract Change Order Proposal
SUMMARY

COR No. (or RFP, ASI, etc.) _____
Date: _____
Project No. _____

Project Name: _____

Contractor Name: _____

Description of Work: _____

Work by General Contractor - General Contractor Direct Costs
(See attached breakdowns)

Breakdown No. ___ _____
Breakdown No. ___ _____
Breakdown No. ___ _____
Breakdown No. ___ _____

Total General Contractor Direct Cost $ - ___% (Max 15%) OH&P _____
(General Contract Direct Cost plus OH&P)

Subcontractor Cost Breakdowns
(See attached.)

Subcontractor Name	Breakdown No.	A Total Direct Cost	B OH&P (Max 15%)	C Total A+(A X B)
_____	___	_____	___%	_____
_____	___	_____	___%	_____
_____	___	_____	___%	_____
_____	___	_____	___%	_____

Subcontractor Direct Costs + Subcontractor OH&P _____
(Sum column C)

General Contractor OH&P on Subcontractor Direct Cost at ___% (Max: 10%) _____
(Sum column A times General Contractor OH&P rate.)

Total Subcontractor Costs with General Contractor OH&P _____

Change Order Subtotal _____
(Sum of Total General Contractor Costs and Total Subcontractor Costs)

Performance and Payment Bond at ___% _____
(Change Order Subtotal times Performance and Payment Bond rate)

Contract amount will be ☐ increased ☐ decreased ☐ unchanged by _____
(Sum of Change Order Subtotal and Performance and Payment Bond)

Contract time will be ☐ increased ☐ decreased ☐ unchanged by _____ days
(Attach supporting data such as meteorological reports)

Construction Contract Change Order Proposal

BREAKDOWN

(Provide one breakdown for each work item.)

Breakdown No. _____

COR No. (or RFP, ASI, etc.) _____

Date: _____

Project No. _____

Project Name: _____

Contractor/Subcontractor Name: _____

Direct Cost of Work :

A. Labor Check here if explained on the Comment Sheet ⬇

		Hourly Wage Rate	Hours	Total Cost
1				
2				
3				
4				
5				
6				
	Add Labor Burden @		____ %	
	LABOR TOTAL			

B. Material

		Unit Price	Unit	Units	Total Cost
1					
2					
3					
4					
5					
6					
	(Copies of invoices may be required.)	Add Tax @		____ %	
	MATERIAL TOTAL				

C. Equipment

		Unit Rate	Unit	Units	Total Cost
1					
2					
3					
4					
5					
6					
	(Copies of invoices may be required.)	Add Tax @		____ %	
	EQUIPMENT TOTAL				

TOTAL DIRECT COST FOR THIS BREAKDOWN:

(Sum A, B & C)

Construction Contract Change Order Proposal

BREAKDOWN COMMENT SHEET

(attached to each Breakdown, if needed)

Breakdown No. _____

COR No. (or RFP, ASI, etc.) _____

Date: _____

Project No. _____

Project Name: _____

_____

Contractor/Subcontractor Name: _____

A. Labor

No. (From BREAKDOWN Sheet)

B. Material

C. Equipment

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

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

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
2. Submit the schedule of values to Architect prior to the Pre-Construction Conference.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

a. Project name and location.
b. Owner's name.
c. Owner's Project number.
d. Name of Architect.
e. Contractor's name and address.
f. Date of submittal.

2. Arrange schedule of values consistent with format of **AIA Document G703 standard form,** with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Change Orders (numbers) that affect value.
    d. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of **five** percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
5. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
6. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
7. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements.
8. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

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

    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
    2. Stored Materials: Payment for stored materials may be made, subject to provisions in the A201 General Conditions.

B. Payment Application Times: The date for each progress payment is indicated in AIA-A201 General Condition, or as indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

    1. Submit draft copy of Application for Payment **seven** days prior to due date for review by Architect.

C. Application for Payment Forms: Use **AIA Document G702 and AIA Document G703** as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. **Architect** will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit signed and notarized digital copy of each Application for Payment to **Architect** via email or other electronic delivery method. Submitted pay applications shall include waivers of liens and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: If requested by the Owner, submit waivers of mechanic's lien from **subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application with each pay application**.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Use Owner provided forms, or AIA document G706A.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Prior to Final Application for Payment: The following items must be submitted.

1. Warranties
2. Operating and Maintenance Manuals
3. Record Drawings
4. Lien Certificate

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
2. Updated final statement, accounting for final changes to the Contract Sum.
3. AIA Document G706, "*Contractor's Affidavit of Payment of Debts and Claims*."
4. AIA Document G706A, "*Contractor's Affidavit of Release of Liens*."
5. AIA Document G707, "*Consent of Surety to Final Payment*."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. RFIs.
3. Digital project management procedures.
4. Web-based Project management software package.
5. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.5 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item(s) needing information or interpretation and all necessary supporting documents.

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 12:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software.

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

1.6 DIGITAL PROJECT MANAGEMENT PROCEDURES

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

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of AIA Document C106 Digital Data Licensing Agreement.

a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of AIA Document C106.

B. Web-Based Project Management Software Package: Provide, administer, and use web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project management software includes, at a minimum, the following features:

a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
b. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
c. Creating and distributing meeting minutes.
d. Management of construction progress photographs.

2. Provide up to seven Project management software user licenses for use of Owner, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.7 PROJECT MEETINGS

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

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

E. Progress Meetings: Conduct progress meetings at monthly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

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

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Daily construction reports.
3. Site condition reports.
4. Unusual event reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

C. Event: The starting or ending point of an activity.

D. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

E. Resource Loading: The allocation of labor and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. PDF file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Daily Construction Reports: Submit at weekly intervals.

D. Site Condition Reports: Submit at time of discovery of differing conditions.

E. Unusual Event Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that is capable of managing construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date to not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled OAC progress meeting.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

1.6 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 10 days of Pre-Construction Meeting.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1.7 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Summary of all work activities.
3. Material deliveries.
4. High and low temperatures and general weather conditions, including presence of rain or snow.
5. Testing and inspection.
6. Accidents & Emergency procedures.
7. Other not listed above.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

C. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
3. Section 02 41 19 "Selective Demolition" for photographic documentation before selective demolition operations commence.
4. Section 31 10 00 "Site Clearing" for photographic documentation before site clearing operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in file metadata tag or in web-based Project management software site:

a. Name of Project.
b. Date photograph was taken.
c. Description of location, vantage point, and direction.
d. Unique sequential identifier keyed to accompanying key plan.

1.3 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time from camera.

D. File Names: Name media files with date, Project area and sequential numbering suffix.

1.4 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect and /or Construction Manager.

1. Flag construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:

1. Underground utilities.
2. Underslab services.
3. Piping.
4. Electrical conduit.
5. Waterproofing and weather-resistant barriers.

D. Periodic Construction Photographs: Take a minimum of 20 photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, within ten (10) calendar days following award of the Contract, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: 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.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Contractor.
5. Name of firm or entity that prepared submittal.
6. Names of subcontractor, manufacturer, and supplier.
7. Category and type of submittal.
8. Submittal purpose and description.
9. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
10. Drawing number and detail references, as appropriate.
11. Indication of full or partial submittal.
12. Location(s) where product is to be installed, as appropriate.
13. Other necessary identification.
14. Remarks.
15. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

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

D. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

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

1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data

in web-based software site to fully identify submittal.

a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. 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.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's

action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect'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.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample set; remainder will be returned.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

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. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

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

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria

in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.8 CONTRACTOR'S REVIEW

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

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return.

1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:



B. Informational Submittals: Architect will review each submittal and will or will not return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will discard submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

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

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.

1. Mockups are used for one or more of the following:

    a. Verify selections made under Sample submittals.
    b. Demonstrate aesthetic effects.
    c. Demonstrate the qualities of products and workmanship.
    d. Demonstrate successful installation of interfaces between components and systems.
    e. Perform preconstruction testing to determine system performance.

2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) in accordance with 29 CFR 1910.7, by a testing agency accredited in accordance with NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria

indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports and documents as specified.

D. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

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

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections.

1.6 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Architect.
3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
7. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
8. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
10. Demolish and remove mockups when directed unless otherwise indicated.

1.7 QUALITY CONTROL

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

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

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

1.8 SPECIAL TESTS AND INSPECTIONS

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

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

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

END OF SECTION 01 40 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

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

B. Water and Sewer Service from Existing System: Water from Owner's existing water system may be available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system may be available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

E. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

F. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

G. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Location of proposed air-filtration system discharge.
2. Waste-handling procedures.
3. Other dust-control measures.

H. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by Owner. Include the following:

1. Methods used to meet the goals and requirements of Owner.
2. Concrete cutting method(s) to be used.
3. Location of construction devices on the site.
4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with Owner.

1.4 QUALITY ASSURANCE

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

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

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts[, with 1-5/8-inch- OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

C. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain-link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

D. Provide wind screen at fencing along and public sides of the project. Include printed graphics;

   a. Fence Wrap Panels are designed in 40’ x 6’ panel sections.
   b. Full Print Coverage. Design for wide format, 4 color process printing.
   c. Designs created in Adobe Illustrator at 400% scale (120” x 18”)
   d. Background screen – **artwork to be provided**
   e. No logos, images, or word printing will be allowed except in this specification or as directed by architect / ASMSA.
   f. Media Properties: Basis of Design – Ultraflex Stripmesh Pro LTX

      a. Airflow: 25%;
      b. Tensile Strength: 218.94 x 182.22 lbs/in;
      c. Tear Strength: 81.13 x 61.51 lbs/in
      d. Flame Resistance: NFPA701
      e. Low Temperature: -4degrees F
      f. Air Permeability: 1736 m2/sec
      g. Ink: CMYK Eco-Solvent Inks
      h. Finishing Properties: 1” High-Strength Seams on all sides, 3/8” Brass grommets applied in 24” increments attached to fence with 7” heavy-duty ties.

   g. Proof to be provided prior to ordering and printing.

2.1 TEMPORARY FACILITIES

A. Field Offices:

1. Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.2 EQUIPMENT

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

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

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

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service:

1. Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

F. Electric Power Service:

1. Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
2. Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

a. Install electric power service overhead unless otherwise indicated.

b. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:

1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Storage and Staging: Use designated areas of Project site for storage and staging needs.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide on 2 (two) - 8 x 4-ft. exterior plywood with continuous treated 1x4 all 4 sides, with 1x4 intermediate verticals behind the boards:

a. Artwork to be provided.
b. Locate on project site as directed by Owner.

c. Install project sign plumb and level, with a minimum of 2 treated 6x6-inch posts, each with treated 2x4 braces, to the ground. Maintain sign in good condition and proper upright position throughout the duration of the project.
d. Submit scaled drawing of sign, showing full listing of persons and entities for approval prior to fabrication of sign. Provide Project identification signs as indicated on Drawings.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touch up signs, so they are legible at all times.

G. Waste Disposal Facilities:

1. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of authorities having jurisdiction. Coordinate with requirements specified in Section 31 10 00 "Site Clearing."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully,

using materials approved by authorities having jurisdiction.

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

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

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

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

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

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

J. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.

2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

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

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the protection and trimming of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.

B. Related Sections include the following:
   1. Division 2 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
   2. Division 2 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.

1.3 SUBMITTALS

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

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

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

1.4 QUALITY ASSURANCE

A. Tree Service Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site on a full-time basis during execution of the Work.

B. Arborist Qualifications: An arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standards: Comply with ANSI A300, "Trees, Shrubs, and Other Woody Plant Maintenance--Standard Practices," unless more stringent requirements are indicated.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
   1. Before starting tree protection and trimming, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities. Review tree protection and trimming procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19 mm) sieve.

B. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch (25 mm) in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches (100 mm) or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, non-woven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

D. Construction Fence: Orange plastic fencing, typical of that used during construction operations. Minimum 3’ height. Attach to metal fence posts with wire ties.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage. Maintain temporary fence and remove when construction is complete. Install chain-link fence according to ASTM F 567 and manufacturer's written instructions.

B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

C. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated. Apply 3-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

D. Do not store construction materials, debris, or excavated material within the drip line of remaining trees. Do not permit vehicles or foot traffic within the drip line; prevent soil compaction over root systems.

E. Do not allow fires under or adjacent to remaining trees or other plants.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.
   1. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches (75 mm) back from new construction.
   2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
   1. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

3.3 REGRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by qualified arborist, unless otherwise indicated.

B. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

C. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

D. Moderate Fill: Where existing grade is more than 6 inches (150 mm), but less than 12 inches (300 mm), below elevation of finish grade, place drainage fill, filter fabric; and topsoil on existing grade as follows:
   1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above elevation of finish grade and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches (150 mm) below elevation of grade.
   2. Place filter fabric with edges overlapping 6 inches (150 mm) minimum.
   3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.4 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.

C. Pruning Standards: Prune trees according to ANSI A300 as follows:
   1. Type of Pruning: Crown cleaning.
   2. Type of Pruning: Crown thinning.
   3. Type of Pruning: Crown raising.
   4. Type of Pruning: Crown reduction.
   5. Type of Pruning: Vista pruning.
   6. Type of Pruning: Crown restoration.

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

E. Chip branches removed from trees. Spread chips where indicated or as directed by Architect.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

B. For trees indicated to remain, and receiving protection per this specification section, no replacement will be required.

C. For dead and damaged trees that the qualified arborist determines to be incapable of restoring to a normal growth pattern, and not properly protected per this specification section, replace per the following requirements:
   1. Provide new trees of the same size and species as those being replaced; plant and maintain as specified in Division 2 Section "Trees and Shrubs."
   2. Provide new trees of 6-inch (150-mm) caliper size and of a species selected by Architect when trees more than 6 inches (150 mm) in caliper size, measured 12 inches (300 mm) above grade, are required to be replaced.

D. Aerate surface soil, compacted during construction, 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augured soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material, displaced trees, and excess chips from Owner's property.

END OF SECTION 015639

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of This Section Includes: Administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for submitting warranties.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluating Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Substitution Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be

replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in "Substitutions" Article.

1.3 QUALITY ASSURANCE

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

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products will be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is inconspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft 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 that products are undamaged and properly protected.

C. Storage:

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

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections are to be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

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

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

2. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Field engineering.
2. Cutting and patching.
3. Progress cleaning.
4. Starting and adjusting.
5. Protection of installed construction.
6. Correction of the Work.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting surveys.
2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 CLOSEOUT SUBMITTALS

A. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when

encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

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

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

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

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and

construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to

Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly.

Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

3.6 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. 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. 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. 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 minimize interruption to occupied areas.

F. 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. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
5. Proceed with patching after construction operations requiring cutting are complete.

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, as judged by Architect. 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 eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, 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, corner to corner of wall and edge to edge of ceiling. 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.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, in accordance with regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces in accordance with

written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

C. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace damaged, defective, or nonconforming Work. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Repair Work previously completed and subsequently damaged during construction

period. Repair to like-new condition.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. List of incomplete items.
4. Submittal of Project warranties.
5. Final cleaning.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 SUBSTANTIAL COMPLETION PROCEDURES

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

B. Procedures Prior to Substantial Completion: Complete the following a minimum of **10** days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Terminate and remove temporary facilities from Project site, along with construction tools, and similar elements.
3. Complete final cleaning requirements.

C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of **10** days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of

Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.5 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.6 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding inside, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.

1.7 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit

Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit on digital media acceptable to Architect.

D. Warranties in Paper Form:

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

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

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

C. Construction Waste Disposal: Comply with waste-disposal requirements in

Section 01 50 00 "Temporary Facilities and Controls."

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation manuals for systems, subsystems, and equipment.
   2. Maintenance manuals for the care and maintenance of products, systems and equipment.

B. Refer to individual specifications Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 SUBMITTALS

A. Manuals: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

PART 2 - PRODUCTS

2.1 MANUALS, GENERAL

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 a title page, table of contents, and manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. 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, address, and telephone number of Contractor.
   6. Name and address of Architect.
   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.

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.

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

2.2 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:
   1. Product name and model number.
   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 start-up, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

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.

2.3 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:
   1. Product name and model number.
   2. Manufacturer's name.
   3. Color, pattern, and texture.
   4. Material and chemical composition.
   5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and maintenance, and repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.4 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment:

D. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, that detail essential maintenance procedures:

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 DIGITAL SET

A. In addition to close-out submittals above, provide a digital copy, scanned or recorded in color, of each of the above items as follows:
   1. Record Drawings
   2. Operating and Maintenance Manuals
   3. Warranties

B. Submit on a thumb drive or DVD, with files and folders appropriately named and titled; organized to be searchable pdf format.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control

sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of operation and maintenance manuals.

F. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.2 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

1.5 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria.
2. System documentation review.
3. Emergencies operation review.
4. Operation procedure review.
5. Adjustments, Troubleshooting, Maintenance and Repair.

1.6 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.7 INSTRUCTION

A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

1.8 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. Provide sign-in sheets with the following information:

    a. Name of Training
    b. Date of Training
    c. Time of Training
    d. Names of Attendees
    e. Signatures of Attendees

2. Submit copies of sign-in sheets to Architect, and include in Operation and Maintenance Manuals.
3. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and

capable of recording in full HD mode.

1. Submit video recordings thumb drive.
2. File Hierarchy: Organize folder structure and file locations in accordance with Project Manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based on name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the equipment demonstration and training recording that describes the following for each Contractor involved on the Project, arranged in accordance with Project Manual table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. Email address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 79 00

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

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. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for formwork related to concrete pavement and walks.
2. Section 321316 "Decorative Concrete Paving" for formwork related to decorative concrete pavement and walks.

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 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, movement, contraction, and isolation joints
c. Forms and form-removal limitations.
d. Anchor rod and anchorage device installation tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form ties.
4. Waterstops.
5. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

    a. Location of construction joints is subject to approval of the Architect and Structural Engineer of Record.

3. Indicate location of waterstops.
4. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and reshoring installation and removal.

C. Samples:

1. For waterstops.
2. For Form Liners: 12-inch by 12-inch sample, indicating texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspection agency.

B. Field quality-control reports.

C. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

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

B. Mockups: Formed surfaces to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship.

1. Build panel approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Architect.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:

    a. Wind Loads: As indicated on Drawings.

        1) Horizontal Deflection Limit: Not more than 1/360 of the wall height.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

1) APA HDO (high-density overlay).
2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces without spiral or vertical seams not exceeding specified formwork surface class.

1. Provide forms with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation, with straight end forms.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

2.3 WATERSTOPS

A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.

2.4 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, 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.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips
2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect and Structural Engineer of Record prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.

4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated on Drawings or at the lesser of twice the height of the wall or 25’-0”, if not indicated on the Construction Documents.

    a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 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.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 INSTALLATION OF WATERSTOPS

A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.

1. Install in longest lengths practicable.
2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
3. Protect exposed waterstops during progress of the Work.

3.4 INSTALLATION OF INSULATING CONCRETE FORMS

A. Comply with ACI 301 and manufacturer's instructions.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Install forms in running bond pattern.

1. Align joints.
2. Align furring strips.
3. Coordinate snap-tie hole layout and spacings with architect on architectural appearance quality concrete.

D. Construct forms tight to prevent loss of concrete mortar.

E. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

G. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

H. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

I. Shore insulating concrete forms to ensure stability and to resist stressing imposed by construction loads.

3.5 REMOVING AND REUSING FORMS

A. 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 support 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.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.6 SHORING AND RESHORING INSTALLATION

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 approved.

B. 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.

3.7 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
2. Inspect insulating concrete forms for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:

1. Section 033816 "Unbonded Post-Tensioned Concrete" for reinforcing related to post-tensioned concrete.
2. Section 034100 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
3. Section 034500 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
4. Section 321313 "Concrete Paving" for reinforcing related to concrete pavement and walks.
5. Section 321316 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.3 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.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.

2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement. Reinforcement schedules alone are not acceptable. The reinforcement shop drawings shall also include sections and details showing reinforcement 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.
3. Reproduction of Contract Drawings shall not be used for shop drawings.
4. Shop drawings shall be coordinated with other trades, construction fit up and project site conditions. The General Contractor shall coordinate this prior to submission of the Shop Drawings.
5. Design Team Review of Shop Drawings:
   a. Shop drawing review is for bar size, spacing, details and general conformation of the Contract Drawings only.
   b. Shop drawings will only be reviewed if transmitted in their entirety, unless previously approved to submit in phases. Incomplete shop drawings will be marked revise and resubmit. Time required by Wallace Design Collective, PC, to review shop drawing submittals more than one time will be billed to the General Contractor at Wallace Design Collective, PC, hourly rates.
   c. Fabrication of materials prior to review of the shop drawings is at the Contractor's risk.

C. Construction Joint Layout: Indicate proposed construction joints required to build the structure.

1. Location of construction joints is subject to approval of the Architect and Structural Engineer of Record.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For delegated-design engineer.

B. Delegated-Design Engineer Qualifications: Include the following:

1. Experience providing delegated-design engineering services of the type indicated.
2. Documentation that delegated-design engineer is licensed in the state in which Project is located.

C. Welding certificates.

1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M

D. Material Certificates: For each of the following, signed by manufacturers:

1. Epoxy-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."
2. Dual-Coated Reinforcement: CRSI's "Epoxy Coating Plant Certification."

E. 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.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 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.

C. Mockups: Reinforcing for cast-concrete formed surfaces, to demonstrate tolerances and standard of workmanship.

1. Build panel approximately 100 sq. ft. for formed surface in the location indicated on Drawings or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 ALLOWANCES

A. Include an allowance in bid price for an additional five (5) percent of the total reinforcing steel. This allowance shall include, but is not limited to, the fabrication, shipping, placement, labor, material, detailing, overhead and profit of the reinforcing steel as directed by the Architect or Structural Engineer of Record.

1.8 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.

1.9 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design structural thermal break insulated connection system, including attachment to building construction.

B. Structural Performance of Structural Thermal Break Insulating Connection System: Structural thermal break insulated connection system shall withstand the following loads and stresses:

1. Dead Loads: As indicated on Drawings.

    a. Shear Load: As indicated on Drawings.
    b. Bending Moment: As indicated on Drawings.

2. Live Loads: As indicated on Drawings.

    a. Shear Load: As indicated on Drawings.
    b. Bending Moment: As indicated on Drawings.

1.10 STEEL REINFORCEMENT

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

B. Low-Alloy Steel Reinforcing Bars: ASTM A706/A706M, deformed.

C. Headed-Steel Reinforcing Bars: ASTM A970/A970M.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

1.11 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. Plate Dowel System: Diamond Dowel System by PNA Construction Technologies or Approved Alternate.

D. 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.

E. Mechanical Splice Couplers: ACI 318 Type 1, same material of reinforcing bar being spliced; tension-compression type.

F. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.

1. Finish: Plain.

G. Stainless Steel Tie Wire: ASTM A1022/A1022M, not less than 0.0508 inch in diameter.

H. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A775/A775M.

I. Zinc Repair Material: ASTM A780/A780M.

1.12 FABRICATING REINFORCEMENT

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

PART 2 - EXECUTION

2.1 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.

2.2 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 or as specified on the Drawings.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, 24 inches, or as specified on Drawings, 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 shall 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.

2.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect or Structural Engineer of Record.

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.

2.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

2.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel-reinforcement placement.

D. 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 032000

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 312001 "Structural Earth Moving" for drainage fill under slabs-on-ground.
4. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

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

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.4 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. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete Subcontractor.
e. Special concrete finish Subcontractor.

2. Review the following:

    a. Special inspection and testing and inspecting agency procedures for field quality control.
    b. Construction joints, control joints, isolation joints, and joint-filler strips.
    c. Semirigid joint fillers.
    d. Vapor-retarder installation.
    e. Anchor rod and anchorage device installation tolerances.
    f. Cold and hot weather concreting procedures.
    g. Concrete finishes and finishing.
    h. Curing procedures.
    i. Forms and form-removal limitations.
    j. Methods for achieving specified floor and slab flatness and levelness.
    k. Floor and slab flatness and levelness measurements.
    l. Concrete repair procedures.
    m. Concrete protection.
    n. Initial curing and field curing of field test cylinders (ASTM C31/C31M.)
    o. Protection of field cured field test cylinders.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement
7. Aggregates.
8. Admixtures:

    a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
9. Vapor retarders.
10. Curing materials.

11. Joint fillers.
12. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification and intended location of placement.
2. Minimum 28-day compressive strength.
3. Proportions of ingredients used for the composition of design mixtures.
4. Durability exposure class.
5. Maximum w/cm.
6. Slump limit.

7. Air content.
8. Nominal maximum aggregate size.
9. Dosage of Admixture
10. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
11. Documentation of average strength
12. Intended placement method.
13. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

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 Architect and Structural Engineer of Record.

D. Samples: For manufacturer's standard colors for color pigment and vapor retarder.

E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.
3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Bonding agents.
5. Adhesives.
6. Vapor retarders.
7. Semirigid joint filler.
8. Joint-filler strips.
9. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures

a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.

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 AC380.

F. Preconstruction Test Reports: For each mix design.

G. Field quality-control reports.

H. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete, incorporating permeability-reducing admixtures.

1. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. 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 certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.

1. Personnel performing laboratory tests shall be an 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. 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 shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

E. Mockups: Cast concrete slab-on-ground and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Slab-On-Ground: Build panel approximately 15 feet by 15 feet in the location indicated or, if not indicated, as directed by Architect.

a. Divide panel into four equal panels to demonstrate saw joint cutting.

2. Formed Surfaces: Build panel approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Architect.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 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. Permeability.

1.9 ALLOWANCES

A. Include an allowance in bid price for an additional five (5) percent of the total concrete and reinforcing steel. This allowance shall include, but is not limited to, the manufacture, shipping, placement, labor, material, detailing, overhead and profit of the concrete and reinforcing steel as directed by the Architect or Structural Engineer of Record.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

B. Concrete supplier shall have sufficient capacity and adequate facilities to provide continuous delivery at the rate required for continuous placement throughout any sequence of placement.

C. Storage of Concrete Materials:
   1. Store cement in weather tight buildings or bins which prevent intrusion of moisture or contaminants. Store different types of cement in separate facilities.
   2. Stockpile aggregates to prevent segregation and contamination with other materials. Thaw frozen aggregates before use.
   3. Sand shall be drained to a uniform moisture content before use.
   4. Store admixtures securely to prevent contamination, evaporation damage or temperature variation in excesses of the range recommended by the manufacturer.

1.11 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and 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 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.
   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.
   5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

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.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

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

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

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 or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C150/C150M, Type I, gray.
2. Fly Ash: ASTM C618, Class C or F. Use only one type and source throughout the project
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Alkali-Silica Reaction: Comply with one of the following:

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.
c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

2. Maximum Coarse-Aggregate Size: 1 inch nominal.
3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those

permitted in hardened concrete. 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. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.
7. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C494/C494M, Type C.

8. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

9. Permeability-Reducing Admixture: ASTM C494/C494M, Type S, hydrophilic, permeability-reducing crystalline admixture, capable of reducing water absorption of concrete exposed to hydrostatic pressure (PRAH).
    a. Permeability: No leakage when tested in accordance with U.S. Army Corps of Engineers CRD C48 at a hydraulic pressure of 200 psi for 14 days.

10. Moisture-Reducing Admixture:
    a. Non-toxic, volatile organic compound (VOC) free, liquid admixture formulated to react with hydroxide ions produced by cement hydration process, creating additional hydration products within capillary pores, blocking moisture vapor movement through concrete
    b. Physical characteristics:
        1) Hydraulic conductivity: Project specific maximum of 6.0 E-8 cm/s per ASTM D5084.
        2) Toxicity: None.
        3) Odor: None.
        4) Flammability: None.
        5) Volatile Organic Compound (VOC) content: 0 grams per liter.
        6) Freeze temperature: 32 degrees F (0 degrees C).
        7) pH: 11.3
    c. Add admixture per manufacturer’s instructions.
    d. Use with firm experienced in manufacture of concrete MVRA.
    e. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
        1) VaporLock 20/20
        2) ISE Logik MVRA 900
        3) Barrier One
        4) Xypex

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01; not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.

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.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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 C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F: Black.
b. Ambient Temperature between 50 deg F and 85 deg F: Any color.
c. Ambient Temperature Above 85 deg F: White.

D. Curing Paper: Eight-feet-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.

E. Water: Potable or complying with ASTM C1602/C1602M.

F. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

G. Clear, Waterborne, Membrane-Forming, Nondissipating Curing Compound: ASTM C309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.

H. Clear, Waterborne, Membrane-Forming, Curing Compound: ASTM C309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.

I. Clear, Solvent-Borne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

J. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 in accordance with ASTM D2240.

C. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 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 C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested in accordance with ASTM C109/C109M.

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 C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
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 in accordance with ASTM C109/C109M.

2.7 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, in accordance with ACI 301.

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.
2. Required Average Strength for each type of concrete:
   a. Where suitable test records for the concrete production facility are available, design strength may be tested on the standard deviation in accordance with ACI 318.
   b. Where strength test records are not available, design strength and documentation of average strength as noted in ACI 318, Chapter 5.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows, unless noted otherwise in specific concrete mix design specification:

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 water-reducing or 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 concrete with a w/cm below 0.50.
4. Slump limits noted are prior to adding water-reducing admixtures. Slump limits shall be no more than 8 inches after adding water-reducing admixtures.
5. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
6. Use permeability-reducing admixture in concrete mixtures where indicated.
7. Use moisture-reducing admixture in concrete mixtures where indicated.

D. Liquid Floor Treatments.

1. Penetrating liquid floor treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surface.

2.8 CONCRETE MIXTURES

A. Class A: Normal-weight concrete used for footings and pedestals.

1. Exposure Class: ACI 318 F0 S0 W0 C1.
2. Minimum Compressive Strength: 3000 psi at 28 days.
3. Maximum w/cm: 0.50.

4. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
5. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.

6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Class B: Normal-weight concrete used for site retaining walls.

1. Exposure Class: ACI 318 F2 S0 W1 C1.
2. Minimum Compressive Strength: 4500 psi at 28 days.
3. Maximum w/cm: 0.45.
4. Maximum Coarse-Aggregate Size: 1 inch nominal.
5. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inchbefore adding high-range water-reducing admixture or plasticizing admixture.
6. Air Content:
   a. Exposure Classes F2: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.

7. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

C. Class C: Normal-weight concrete used for interior slabs-on-ground.

1. Exposure Class: ACI 318 F0 S0 W0 C1.
2. Minimum Compressive Strength: 4000 psi at 28 days.
3. Maximum w/cm: 0.50.
4. Maximum Coarse-Aggregate Size: 1 inch nominal.
5. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture.
6. Air Content:

   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.

7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

D. Class D: Normal-weight concrete used for Exterior Structural Concrete.

1. Exposure Class: ACI 318 F3 S0 W1 C2.
2. Minimum Compressive Strength: 5000 psi at 28 days.
3. Maximum w/cm: 0.40.
4. Maximum Coarse-Aggregate Size: 1 inch nominal.
5. Slump Limit: 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inchbefore adding high-range water-reducing admixture or plasticizing admixture.
6. Air Content:
   a. Exposure Classes F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size.

7. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, 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 in accordance with ASTM C94/C94M. 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 five 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 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

   1. Before placing concrete, verify that installation of concrete forms, accessories, and 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 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.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
3. 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.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
4. Lap joints 6 inches and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 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 Architect or Structural Engineer of Record.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Space vertical joints in walls as indicated on Drawings. Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible. Joists shall align with the slab-on-grade control joints unless indicated on Drawings.
7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Walls: 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. Space joints as indicated on drawings with a 20 foot maximum. Provide shop drawing that indicates control joint spacing in walls

D. 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:
    a. Primary Method: Soft-Cut System method, by Soff-Cut International, Corona, CA (800) 776-3328. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within 2 hours after final finish at each saw cut location.
    b. Optional Method (Where Soft-Cut System Method Equipment is Not Available): 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. Properly time cutting with the set of the concrete. Saw-Cut control joints within 12 hours after finishing. Complete cutting before shrinkage stresses become sufficient to produce cracking.

3. Spacing: Provide joints at locations as noted on Contract Drawings.
   a. Placement of saw joints must be coordinated with the tile joints and this requirement governs over locations shown on the Contract Drawings.

E. 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.

F. 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.

G. Dowel Plates: Install dowel plates at joints where indicated on Drawings or as alternate to to dowel bars indicated in the slab-on-grade. Contractor shall verify with Structural Engineer of Record that substitution locations are acceptable prior to installation of dowel plates.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect or Structural Engineer of Record in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. 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.

F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required. Confirm with Architect and Structural Engineer of Record before proceeding with a specific slope or on exterior concrete without a specific slope.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
    b. Remove projections larger than 1 inch.
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 Class D.
    e. Apply to concrete surfaces not exposed to public view.

2. ACI 301 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 to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

3. ACI 301 Surface Finish SF-3.0:

    a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    b. Remove projections larger than 1/8 inch.
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 Class A.
    e. Locations: Apply to concrete surfaces exposed to public view,.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

    a. Perform no later than one day after form removal.
    b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
    c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch in one direction.
3. Apply scratch finish to surfaces to receive concrete floor toppings and to receive mortar setting beds for bonded cementitious floor finishes

C. Float Finish:

1. When bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operation of specific float apparatus, consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats.
2. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture and complies with ACI 117 tolerances for conventional concrete.
3. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

D. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with Architect before application.
2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 FINISH FLOOR TOLERANCES

A. Finish floor tolerances shall meet the following:

1. Trowel finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:

a. Slabs on Ground:

1) 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 3/16 inch.
2) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.

3.10 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 blend with in-place construction.
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 steel-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. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
4. 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. Drill and epoxy into concrete base with approved concrete epoxy material.
5. For supported equipment, install approved anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.

a. Verify with Structural Engineer of Record the location, size and thickness of equipment base/
b. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
c. Cast anchor-bolt insert into bases.
d. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.

1. Cast-in inserts and accessories, as shown on Drawings.
2. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 and ACI 306.1 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 before and during finishing operations.

B. Cold-Weather Placement: Comply with ACI 306.1, ACI 306R 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 the average of the highest and lowest ambient temperature from midnight to midnight is expected to be less than 40 degrees F for more than three successive days, deliver concrete to meet the following minimum temperatures immediately after placement:
   a. 55 degrees F for sections less than 12 inches in the least dimension;
   b. 50 degrees F for sections 12 to 36 inches in the least dimension;
   c. 45 degrees F for sections 36 to 72 inches in the least dimension; and
   d. 40 degrees F for sections greater than 72 inches in the least dimension.
2. The temperature of concrete as placed shall not exceed these values by more than 20 degrees F. If exceeded, concrete shall not be placed and engineer of record shall be notified.
3. The minimum requirements may be terminated when temperatures above 50 degrees F occur during more than half of any 24 hour duration.
4. When the outdoor temperature is less than 40 degrees F, maintain temperature of placed concrete at not less than 50 degrees F for required curing time.
5. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
6. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement: Comply with ACI 301, ACI 305.1, ACI 305R, and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. If exceeded, concrete shall not be placed and engineer of record shall be notified. 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. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by ACI 305R. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, fog spray, covering with polyethylene sheeting, or wet cover.

D. Windy Weather Placement: Comply with ACI 301, ACI 305.1, ACI 305R and as follows:

E. Precautions to protect fresh concrete from developing plastic shrinkage cracks must be taken in advance of concrete placement when evaporation rate due to any combination of temperature, humidity, and wind velocity is expected to approach 0.2 lb./sq. ft./hr. as determined by ACI 305R. Acceptable precautions to reduce the rate of evaporation include use of wind breaks, fog spray, covering with polyethylene sheeting, or wet cover.

F. 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. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period with one of the following:

    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.

G. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12-inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

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.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Curing Compound:

1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.
4) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.

c. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.

2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

H. Liquid Floor Treatment Application

1. Penetrating liquid floor treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
    1) Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
    2) Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.12 TOLERANCES

A. Conform to ACI 117.

3.13 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month(s).
2. 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 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.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Concrete:

1. Repair and patch defective areas when approved by Architect or Structural Engineer of Record.
2. Remove and replace concrete that cannot be repaired and patched to Architect's or Structural Engineer of Record's approval.

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, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. 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 strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by 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, and other objectionable conditions.
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 cutting out low areas and replacing with 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 Architect or Structural Engineer of Record’s approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 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: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall 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.
        13) Information on storage and curing of samples before testing, 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.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections:

1. Headed bolts and studs.
2. Anchor Rods
3. Verification of use of required design mixture.
4. Concrete placement, including conveying and depositing.
5. Curing procedures and maintenance of curing temperature.
6. Verification of concrete strength before removal of shores and forms from beams and slabs.
7. Batch Plant Inspections: On a random basis, as determined by Architect.
8. All other special inspection items as noted on the Contract Drawings.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall 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 50 cu. yd. or fraction thereof. For slabs, obtain at least one composite sample for the minimum of each 150 cubic yard or each 5,000 square feet of slab placed each day.

    a. One Composite sample shall consist of a minimum of four cylinders.
    b. When frequency of testing provides 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.

2. Slump: ASTM C143/C143M:

    a. 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.
    b. Perform additional tests when concrete consistency appears to change.

3. Slump Flow: ASTM C1611/C1611M:

    a. 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.
    b. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;.

    a. 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 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.

6. Unit Weight: ASTM C567/C567M fresh unit weight of 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.

7. Compression Test Specimens: ASTM C31/C31M:

    a. Cast and laboratory cure two sets of four 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
    b. Cast, initial cure, and field cure two sets of four standard cylinder specimens for each composite sample.

8. Compressive-Strength Tests: ASTM C39/C39M.

    a. Test one set of two laboratory-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 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 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.
11. 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.
12. Additional Tests:

    a. 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.
    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 Architect.

        1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.

13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
15. Inspection Reports shall include items inspected, inspection locations and verification of compliance or deviations from the Contract Documents.
16. Concrete strength tests made and tested by testing laboratory shall be the sole criteria of concrete strength unless in-situ tests are made in accordance with the Building Code by a qualified independent testing laboratory. Concrete for which strength tests do not meet criteria for acceptance shall be considered inadequate until proven otherwise.
17. Where concrete strength tests fail to meet the criteria specified herein, the Structural Engineer of Record shall be the sole judge of structural adequacy of concrete.

a. The burden of proof of structural adequacy shall be the responsibility of the Contractor.
b. If upon the evaluation of structural adequacy the testing is inadequate strength, in opinion of the Structural Engineer of Record, portions of the structure shall be repaired or removed and replaced as directed by the Structural Engineer of Record at no additional expense to the owner.

18. If strength tests fall below the specified strength, Contractor shall either improve curing conditions or shall modify the design mixtures to improve strength.

F. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 48 hours of completion of floor finishing and promptly report test results to Architect.

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brick.
2. Mortar and grout materials.
3. Reinforcement.
4. Embedded flashing.
5. Accessories.
6. Mortar and grout mixes.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.

C. Related Requirements:

1. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: for the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples:

1. Clay face brick, in the form of straps of five or more bricks.
2. Colored mortar.
3. Weep/cavity vents.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type of the following:

1. Masonry units.

    a. Include material test reports substantiating compliance with requirements.
    b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    c. For exposed brick, include test report for efflorescence in accordance with ASTM C67/C67M.

2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test in accordance with ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, in accordance with ASTM C1019, for grout mixes required to comply with compressive strength requirement.

C. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 MOCKUPS

A. Sample Panel Mockups: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 01 40 00 "Quality Requirements" for mockups.

1. Build sample panels for typical exterior wall in sizes approximately 60 inches long by 48 inches high. Built to wall thickness with exact cavity and backing structures specified.
2. Mock-up to include full range of brick selected, or to be matched, including color variations and textures.
3. Construct mockup with specified bond pattern.
4. Bead and head joints to maintain uniform depot and thickness, and with tooling as indicated.
5. Utilize mortar mix specified.
6. Mockup must include each of the following:

a. Inside corner
b. Outside corner
c. Expansion joint
d. Anchors
e. Door jamb, and all relevant flashings
f. Window jamb and sill, and all relevant flashings
g. Weeps / vents
h. Air barrier, sheathing, back-up framing, drainage devices, fluid applied waterproofing and or other required wall component as indicated in the Contract Documents.

7. Build sample panels facing south.
8. Where masonry is to match existing, build panels adjacent and parallel to existing surface. Coordinate location with Architect.
9. Clean one-half of exposed faces of panels with masonry cleaner indicated.
10. Protect approved sample panels from the elements with weather-resistant membrane.
11. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.

    a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
    b. Sample will be reviewed from a distance of 20-feet for aesthetic approval.

12. Mock-ups to remain in place, on site until Substantial Completion, or until removal is directed by Architect.
13. Mock-ups will not be allowed to remain as work in-place and must be properly removed at the end of the project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry

when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

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 from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

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

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. For exposed masonry units and cementitious mortar components, obtain each color and grade from single source with resources to provide materials of consistent quality in appearance and physical properties.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.3 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Clay Face Brick: Facing brick complying with ASTM C216 or hollow brick complying with ASTM C652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area), Grade MW or Grade SW, Type FBX or Type HBX.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acme Brick Company
    b. Belden Brick Company (The)
    c. Cherokee Brick
    d. Watsontown

2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M.
3. Efflorescence: Provide brick that has been tested in accordance with ASTM C67/C67M and is rated "not effloresced."
4. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
5. Application: Use where brick is exposed unless otherwise indicated.
6. Provide face brick matching color range, texture, and size of existing brickwork at adjacent buildings.

    a. Basis of Design is to match existing brick on campus, color, shape, and texture.

2.4 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content will not be more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime

containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Cement: ASTM C1329/C1329M.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
2. Pigments do not exceed 10 percent of portland cement by weight.
3. Pigments do not exceed 5 percent of mortar cement by weight.

H. Preblended Dry Mortar Mix: Packaged blend made from portland cement and hydrated lime or mortar cement, sand, mortar pigments, water repellents, and admixtures and complying with ASTM C1714/C1714M.

1. Preblended Dry Portland Cement Mortar Mix:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Amerimix is a trademark of Bonsal American, an Oldcastle company
2) Quikrete; The QUIKRETE Companies, LLC
3) Sakrete; CRH Americas, Oldcastle APG
4) SPEC MIX, LLC

I. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

J. Aggregate for Grout: ASTM C404.

K. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

L. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

M. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: ASTM A951/A951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 ft., with prefabricated corner and tee units.

2.6 TIES AND ANCHORS

A. General: Ties and anchors extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A1064/A1064M, with ASTM A153/A153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire.

D. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A153/A153M.

E. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100 lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.0785-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch-diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Masonry-Veneer Anchors; Vertical Slotted L-Plate: Rib-stiffened, sheet metal anchor section with screw holes at top and bottom, projecting vertical leg with slotted hole for wire tie.

    a. Basis of Design Product: Subject to compliance with requirements provide Hohmann & Barnard, BL-407 Veneer Anchor/Tie or equivalent products by one of the following:

        1) 3GEN Masonry Products, Inc.
        2) Wire-Bond

2.7 EMBEDDED FLASHING

A. Flexible Flashing: Use the following unless otherwise indicated:

1. Copper-Fabric Flashing: 5 oz./sq. ft. self-adhesive copper sheet bonded between two layers of glass-fiber cloth.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advanced Building Products Inc.
        2) Hohmann & Barnard, Inc
        3) Wire-Bond

B. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

C. Termination Bars for Flexible Flashing: Stainless steel bars 0.075 inch by 1 inch.

2.8 ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

C. Weep/Cavity Vents: Use the following unless otherwise indicated:

1. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hohmann & Barnard, Inc
        2) Keene Building Products
        3) Mortar Net Solutions

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Mortar Deflector: Strips, full depth of cavity and 16 inches high, with dovetail-shaped notches that prevent clogging with mortar droppings.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Hohmann & Barnard, Inc
        2) Keene Building Products
        3) Mortar Net Solutions

E. Proprietary Acidic Masonry Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.; a Hohmann & Barnard company
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc

2.9 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. For exterior masonry, use portland cement-lime mortar.
3. For reinforced masonry, use mortar cement mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For reinforced masonry, use Type S.
2. For exterior, above-grade, load-bearing, nonload-bearing walls, and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

D. Pigmented Mortar: Use colored cement product.

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for brick veneer mortar joints.

E. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 or paragraph 4.2.1.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested in accordance with ASTM C67/C67M. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 ft., 1/4 inch in 20 ft., or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 ft., 3/8 inch in 20 ft., or 1/2-inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 ft., or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels,

posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow brick as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive air barrier and cavity wall insulation unless otherwise indicated.

F. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

G. Intersecting and Abutting Walls: Unless vertical expansion or control joints are indicated at juncture, bond walls together as follows:

1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

3.6 ANCHORED MASONRY VENEERRS

A. Anchor masonry veneers to column/support member with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors to column/support member with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 25

inches o.c. horizontally, with not less than one anchor for each 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of column/support member.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and top of walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at corners by using prefabricated L-shaped units.

D. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, pilasters, pipe enclosures, and other special conditions.

3.8 CONTROL AND EXPANSION JOINTS

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

B. Form control joints in concrete masonry as follows:

1. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where indicated and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are indicated without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape[as recommended by flashing manufacturer].
2. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face inner wall at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches. Fasten upper edge of flexible flashing face of inner wall through termination bar.
3. At lintels and shelf angles, extend flashing 6 inches minimum, to edge of next full unit at each end. At heads and sills, extend flashing 6 inches minimum, to edge of next full unit and turn ends up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
2. Space weep holes 24 inches o.c. unless otherwise indicated.

D. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Accessories" Article.

3.11 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during

construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements will be at Contractor's expense.

B. Inspections: Special inspections in accordance with Level 2 in TMS 402.

C. Mortar Test (Property Specification): For each mix provided, in accordance with ASTM C780. Test mortar for mortar air content and compressive strength.

D. Grout Test (Compressive Strength): For each mix provided, in accordance with ASTM C1019.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before

proceeding with cleaning of masonry.

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

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Masonry Waste Recycling: Return broken CMUs to manufacturer for recycling.

C. Excess Masonry Waste: Remove excess clean masonry waste and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.
2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other steel items not defined as structural steel.
3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for painting requirements.

1.2 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of 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.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.
4. Threaded rods.
5. Shop primer.
6. Shrinkage-resistant grout.

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.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.
9. Fabrication of materials prior to review of shop drawings shall be taken at the Contractor’s risk.
10. Review of shop drawings is for member sizes, spacings, details and general compliance only.
11. Material quantities, lengths, fit-up, verification of job site conditions and coordination with other trades are the responsibility of the Contractor.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

D. Delegated-Design Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, professional engineer and testing agency.

B. Welding certificates.

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 materials, 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.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control reports.

1.7 ALLOWANCE

A. Include an allowance in the bid price for an additional five (5) percent of the total structural steel to be fabricated and placed as directed by Architect or Engineer. Allowance is to include, but not limited to, material, detailing, fabrication, shipping, installation, overhead and profit.

B.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Quality Control Welding Inspector Qualifications: Qualified to the satisfaction of the fabricator's or erector's Quality Control Program, as applicable, and in accordance with either of the following:
1. Associate welding inspectors (AWI) or higher as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors.
2. Qualified under the provisions of AWS D1.1 subclause 6.1.4.

E. Quality Control Bolting Inspector Qualifications: Qualified on the basis of documented training and experience in structural bolting inspection.

F. Quality Assurance Welding Inspector Qualifications: Qualified to the satisfaction of the quality assurance agency's written practice, the requirements of the Authority Having Jurisdiction, and either of the following:
1. Welding inspectors (WIs) or senior welding inspectors (SWIs) as defined in AWS B5.1, Standard for the Qualification of Welding Inspectors, except associate welding inspectors (AWIs) are permitted to be used under the direct supervision of WIs, who are on the premises and available when weld inspection is being conducted.
2. Qualified under the provisions of AWS D1.1, subclause 6.1.4.

G. Quality Assurance Bolting Inspector Qualifications: Qualified on the basis of documented training and experience in structural bolting inspections.

H. Nondestructive Testing (NDT) Personnel Qualifications: Qualified in accordance with their employer's written practice, which shall meet or exceed the criteria of AWS D1.1 Structural Welding Code – Steel, subclause 6.14.6 and:
1. American Society of Nondestructive Testing (ASNT) SNT-TC-1A, Personnel Qualification and Certification In Nondestructive Testing.

2. ASNT CP-189, Standard for the Qualification and Certification of Nondestructive Testing Personnel.

I. 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."

1.9 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 F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

Manufacturers and products listed in this Section are neither recommended nor endorsed by the AIA or Deltek. Before selecting manufacturers and products, verify availability, suitability for intended applications, and compliance with minimum performance requirements. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

Product options commonly available from manufacturers are included in square brackets throughout the Section Text. Not every manufacturer listed can provide every option offered; verify availability with manufacturers. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 341.
3. ANSI/AISC 360.
4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:

1. For structural steel connections not designed on the Contract Drawings, submit design calculations and connections in accordance with ANSI/AISC 303 by

fabricator's qualified professional engineer. Member reinforcement at connections is indicated on Drawings.

a. Select and complete connections using schematic details indicated and ANSI/AISC 360.
b. Use Load and Resistance Factor Design; data are given at factored-load level.

C. Moment Connections: Type FR, fully restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A992/A992M.

B. Channels, Angles: ASTM A36/A36M.

C. Plate and Bar: ASTM A36/A36M.

D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.

E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.

1. Weight Class: As Indicated on the Drawings.
2. Finish: Black except where indicated to be galvanized.

F. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.

G. Steel Forgings: ASTM A668/A668M.

H. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1, compressible-washer type with plain finish.

B. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

C. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

1. Studs shall be of uniform diameter, heads concentric and normal to shaft, and weld end chamfered and solid flux.
2. For shear stud connectors thru composite deck:
   a. Provide shear stud connectors with proper ferrules and accessories especially designed to create composite deck action by mating of shear connectors, concrete deck and supporting beam, and capable of providing shear forces shown on Contract Drawings when welded through deck used on the project.
   b. Height: At least 1-1/2 inch above top of deck after installation, with at least 3/4 inch clear concrete cover above top of stud, unless noted otherwise on Contract Drawings.

2.4 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A563 heavy-hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436, Type 1, hardened carbon steel.
5. Finish: Plain.

B. Threaded Rods: ASTM A36/A36M.

1. Nuts: ASTM A63 heavy-hex carbon steel.
2. Washers: ASTM F436, Type 1, hardened carbon steel.
3. Finish: Plain.

2.5 PRIMER

A. Steel Primer:

1. Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
2. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.6 SHRINKAGE-RESISTANT GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.7 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing 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 in accordance with SSPC-SP 3.

F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded-Steel Door Frames: Build up welded-steel door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated on Drawings.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.8 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.9 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 of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces unless indicated to be painted.
6. Corrosion-resisting (weathering) steel surfaces.
7. Surfaces enclosed in interior construction.
8. Top flanges of beams with shear connectors to support metal deck.

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.
2. SSPC-SP 3.
3. SSPC-SP 7 (WAB)/NACE WAB-4.
4. SSPC-SP 14 (WAB)/NACE WAB-8.
5. SSPC-SP 11.
6. SSPC-SP 6 (WAB)/NACE WAB-3.
7. SSPC-SP 10 (WAB)/NACE WAB-2.
8. SSPC-SP 5 (WAB)/NACE WAB-1.
9. SSPC-SP 8.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Prepare faying surfaces of slip critical connections in accordance with RCSC.

E. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 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.

2.10 SOURCE QUALITY CONTROL

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

1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    c. Ultrasonic Inspection: ASTM E164.
    d. Radiographic Inspection: ASTM E94/E94M.

4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:

    a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
    b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.

5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep 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 on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten 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 shrinkage-resistant 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 grouting.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

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 are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect and Structural Engineer of Record. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/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, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

C. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.

3.5 INSTALLATION OF PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with ANSI/AISC 360, manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

3.6 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. 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.

    a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting." Section 099123 "Interior Painting."

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.7 FIELD QUALITY CONTROL AND ASSURANCE

A. Contractor shall retain a duly designated person who acts for, and in behalf of, the Contractor on all inspection and quality matters within the scope of AISC 360-16, AWS D1.1 and of the Contract Documents.

B. Special Inspections: Owner will engage a special inspector to perform testing and verification inspections as noted below along with inspection schedule items included in the Contract Drawings. Testing Agency shall prepare test and inspection reports and submit in writing to Owner, Authority Having Jurisdiction, Engineer of Record, and Owner's consultants within 48 hours of testing or inspections. Reports shall contain Project identification name and number, date of inspection, name of testing and inspecting agency and location of inspected or tested work. In addition, reports shall include verification of compliance or deviations from the Contract Documents.

C. The special inspector shall submit the following to the fabricator and erector:

1. Inspection reports.
    a. Verify structural-steel materials and inspect steel frame joint details.
    b. Verify weld materials and inspect welds.
    c. Verify connection materials and inspect high-strength bolted connections.

2. Nondestructive testing reports
3. Nonconformance reports
4. Reports of repair, replacement or acceptance of nonconforming items

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

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

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

b. In addition to visual inspections, field complete penetration groove welds shall be tested by either of the following, at testing agency's option or as specified on the Contract Documents:
1) Ultrasonic Inspection: ASTM E 164
2) Radiographic Inspection: ASTM E 94

c. In addition to visual inspections, ultrasonic testing (UT) of welds shall be performed as specified on the Contract Documents.
1) The ultrasonic testing (UT) rejection rate shall be determined as the number of welds containing defects divided by the number of welds completed. Welds that contain acceptable discontinuities shall not be considered as having defects when the rejection rate is determined. For evaluating the rejection rate of continuous welds over 3 feet in length where the effective throat is 1 inch or less, each 12 inch increment of fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 feet in length where the effective throat is greater than 1 inch, each 6 inches of length or fraction thereof shall be considered one weld
2) The percentage of required testing may be reduced or shall be increased according to the following:
a) For projects that contain 40 or fewer welds, there shall be no reduction in the ultrasonic testing rate. The rate of UT is permitted to be reduced if approved by the Engineer of Record and the Authority Having Jurisdiction. Where the initial rate of UT is 100%, the nondestructive testing (NDT) rate for an individual welder or welding operator is permitted to be reduced to 25%, provided the reject rate, the number of welds containing unacceptable defects divided by the number of welds completed, is demonstrated to be 5% or less of the welds tested for the welder or welding operator. A sampling of at least 40 completed welds shall be made for such reduced evaluation on each project.
b) For structures in Risk Category II and higher, where the initial rate for UT is 10%, the NDT rate for an individual welder or

welding operator shall be increased to 100% should the rejection rate, the number of welds containing unacceptable defects divided by the number of welds completed, exceeds 5% of the welds tested for the welder or welding operator. A sampling of at least 20 completed welds on each project shall be made prior to implementing such an increase. In the rejection rate for the welder or welding operator falls to 5% or less on the basis of at least 40 completed welds, the rate of UT may be to 10%. For evaluation the reject rate of continuous welds over 3 feet in length where the effective throat is 1 inch or less each 12 inch increment or fraction thereof shall be considered as one weld. For evaluating the reject rate on continuous welds over 3 feet in length where the effective throat is greater than 1 inch, each 6 inches of length or fraction thereof shall be considered one weld.

3. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   a. Initial testing of shear studs at start of work period: Test weld on at least 2 shear studs at start of each work period to determine proper generator control unit, and stud welder settings. Bend studs 45 degrees from vertical by striking with hammer. Inspect weld. Do not include these studs in required total number of studs required on beam. Contractor shall add replacement studs to supplement studs tested by bending 45 degrees.
   b. Visually inspect welds at shear studs: Visually inspect all studs. Test studs that do not appear to have full sound 360 degrees fillet weld at base. Test by bending 15 degrees from vertical toward nearest end of beam by striking with hammer. Contractor shall replace studs that fail this test.
   c. Periodic field testing of shear studs: Test one stud on each beam or girder after weld cools. Test by bending 15 degrees from vertical toward nearest end of beam by striking with hammer. If a tested stud fails at weld, all studs on the same beam or girder shall be tested by same procedure. Contractor shall replace studs that fail this test.

END OF SECTION 051200

SECTION 052100 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. K-series steel joists.
2. KCS-type K-series steel joists.
3. K-series steel joist substitutes.
4. Steel joist accessories.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing bearing plates in concrete.
2. Section 051200 "Structural Steel Framing" for field-welded shear connectors.

1.3 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:

1. Include layout, designation, number, type, location, and spacing of joists.
2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
3. Include safe load carrying capacity of each joist or girder by standard joist designations or by special loads in accordance with the requirements on the Documents.

a. Indicate all special loadings, axial loads and concentrated loads on shop and erection drawings.

4. Indicate locations and details of bearing plates to be embedded in other construction.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Mill Certificates: For each type of bolt.

F. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

G. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8 SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated on Drawings.

1. Use ASD; data are given at service-load level.
2. Design special joists to withstand design loads with live-load deflections no greater than the following:
   a. Roof Joists: Vertical deflection of 1/240 of the span.

3. Design special joists to withstand design loads with total-load deflections no greater than the following:
   a. Roof Joists: Vertical deflection of 1/180 of the span.

2.2 STEEL JOISTS

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

1. Joist Type: K-series steel joists.
2. K-Series Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.
3. Provide holes in chord members for connecting and securing other construction to joists.
4. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated on Drawings, complying with SJI's "Specifications."
5. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated on Drawings, complying with SJI's "Specifications."
6. Do not camber joists.
7. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.3 PRIMERS

A. Primer:

1. SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15.
2. Provide shop primer that complies with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

2.4 STEEL JOIST ACCESSORIES

A. Bridging:

1. Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A36/A36M steel with integral anchorages of sizes and thicknesses indicated on Drawings. Shop prime paint.

C. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction.

1. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated on Drawings.
2. Finish: Plain, uncoated.

E. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Plain.

F. Welding Electrodes: Comply with AWS standards.

G. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.5 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Replace bent or warped joists damaged during handling and erection.

B. Do not install joists until supporting construction is in place and secured.

C. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.
2. Space, adjust, and align joists accurately in location before permanently fastening.
3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

D. Field weld joists to supporting steel bearing plates and framework. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

E. Bolt joists to supporting steel framework using carbon-steel bolts.

F. Bolt joists to supporting steel framework using high-strength structural bolts. Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for high-strength structural bolt installation and tightening requirements.

G. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.3 REPAIRS

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Touchup Painting:

1. Immediately after installation, clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

    a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
    b. Apply a compatible primer of same type as primer used on adjacent surfaces.

2. Cleaning and touchup painting are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections. In addition, the testing agency shall perform field tests and inspections as noted below along with the inspection schedule items included in the Contract Drawings. The testing agency shall prepare test and inspection reports and submit to the Owner and the Owner's consultants.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E165/E165M.
    b. Magnetic Particle Inspection: ASTM E709.
    c. Ultrasonic Testing: ASTM E164.
    d. Radiographic Testing: ASTM E94.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

END OF SECTION 052100

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof deck.

B. Related Requirements:

1. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
2. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Roof deck.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Welding certificates.
2. Product Certificates: For each type of steel deck.

B. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   a. Power-actuated mechanical fasteners.
   b. Acoustical roof deck.
2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For welding personnel.

1.5 QUALITY ASSURANCE

E. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

G. 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.

H. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its RoofNav for Class 1 fire rating and Class 1-90 windstorm ratings. Identify materials with FM Approvals Certification markings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Do not overload deck during construction by workers or storage of materials.

C. Rusted, crimped or bent deck shall not be installed in the work. Replace damaged deck with new material at no additional cost to the owner.

D. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 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 E119; 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.

2.2 ROOF DECK

A. 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 A653/A653M, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

A. 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. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Weld Washers: Uncoated steel sheet, shaped to fit deck rib, 0.0598 inch thick, with factory-punched hole of 3/8-inch minimum diameter.

J. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

K. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch-wide flanges and level recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

L. Galvanizing Repair Paint: ASTM A780/A780M.

M. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

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. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: 5/8 inch, nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Weld Washers: Install weld washers at each weld location.

B. Mechanical Fasteners: Deck shall be attached to supporting members as noted on the Contract Drawings.
1. Spacing of fasteners shall not exceed 12 inches along each support, unless noted otherwise on the Contract Drawings.
2. Attachment shall be done immediately after the deck units are aligned.
3. Deck units shall have side laps fastened at 36 inches on center or at midspan (whichever is smaller) for spans greater than 5 feet unless otherwise specified on the Contract Drawings.
4. Fasten deck to perimeter members parallel to deck span at 36 inches on center maximum for spans greater than 5 feet unless otherwise specified on the Contract Drawings.

C. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches and as noted on the Contract Drawings.

D. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and weld flanges to top of deck. Space welds not more than 12 inches apart with at least one weld at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and weld.

F. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

B. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
3. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
4. Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair blow-holes at welds with 18 gage plates welded in place. Replace entire sections of deck where holes cannot be satisfactorily repaired

3.5 HANGERS FOR MISCELLANEOUS EQUIPMENT

A. Do not attach hangers for ductwork, mechanical piping, or ceilings directly to metal deck.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency to perform tests and inspections as noted below along with inspection schedule items included in the Contract Drawings. Testing agency shall prepare test and inspection reports and submit to the Owner and the Owner’s consultants.

B. Inspect condition of deck units for damage and corrosion. Report deficiencies.

C. Inspect size, spacing, and quality of connections of deck to structure and at side laps for conformance with Contract Drawings. Report deficiencies.

D. Deck: Inspect deck at welded connections. Connections do not conform to specifications where deck is not intact after welding and where blow holes occurred.

E. Field welds will be subject to inspection.

F. Prepare test and inspection reports.

G. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

END OF SECTION 053100

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-formed steel framing.
2. Exterior non-load-bearing wall framing.
3. Vertical deflection clips, exterior.
4. Interior non-load-bearing wall framing.
5. Vertical deflection clips, interior.
6. Soffit framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include confirmation of compliance with AISI S200 / AISI S240 / AISI S220 marking standards.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
3. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Delegated Design Submittal: For cold-formed steel framing, using actual (non EQ) design thickness, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Delegated Design Engineer Qualifications: For cold-formed steel framing.

1.5 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

B. Minimum Base metal thickness must comply with ASTM C955 without exceptions. **"EQ studs" or "base metal equivalents" are not allowed**.

C. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

A. Product Identification: Track and stud members must be clearly and legibly stamped, embossed, or otherwise marked by the manufacturer in accordance with AISI S200 / AISI S240 / AISI S220.

B. Marking Interval: Ensure markings repeat at a maximum spacing of 96-inches on center along the length of each member.

C. Minimum Label Data: Provide product information directly on the member to include:

1. Manufacturer's identification (name, logo, or trademark)
2. Complete section designation (mil size, shape, flange, and thickness)
3. Minimum uncoated base metal thickness (in mils or inches)
4. Protective coating designation

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on structural drawings.
2. Deflection Limits: Design framing systems to withstand design loads without

deflections greater than the following:

a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/240 at gypsum board and 1/360 at ceramic tile walls of the wall height under a horizontal load of 5 lbf/sq. ft.
c. Roof Rafter Framing: Vertical deflection of 1/360 of the horizontally projected span for live loads.
d. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1/2 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240.

2.3 COLD-FORMED STEEL FRAMING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AllSteel & Gypsum Products, Inc.
2. ClarkDietrich
3. Consolidated Fabricators Corp.; Building Products Division
4. Mill Steel Framing; Mill Steel Company
5. Steel Construction Systems; Stone Group of Companies
6. Super Stud Building Products Inc.
7. TELLING Industries

B. Framing Members, General: Comply with AISI S240 for conditions indicated.

C. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: ST50H.
2. Coating:

   a. Interior Walls - G60, A60, AZ50, or GF30
   b. Exterior Walls & Soffits - G90 or equivalent.

D. Steel Sheet for Vertical Deflection Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 50, Class 1 grade.
2. Coating:

    a. Interior Walls - G60, A60, AZ50, or GF30
    b. Exterior Walls & Soffits - G90 or equivalent.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: 0.0538 inch.
2. Flange Width: 1-5/8 inches.
3. Gage – as indicated

    a. Full steel sheet thickness required; **“EQ” type designations not permitted**.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.
3. Gage – as indicated

    a. Full steel sheet thickness required; **“EQ” type designations not permitted**.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Steel Thickness: 0.0538 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
3. Gage – as indicated

    a. Full steel sheet thickness required; **“EQ” type designations not permitted**.

D. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated,

punched, with stiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: 0.0538 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Steel Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Steel Thickness: 0.0538 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.

D. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 SOFFIT FRAMING

A. Exterior Soffit Framing: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: 1-5/8 inches, minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic-coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.

9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process in accordance with ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process in accordance with ASTM A153/A153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Type: Torque-controlled expansion anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/ASTM F1941M, Class Fe/Zn 5, unless otherwise indicated.
4. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M or SSPC-Paint 20.

B. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as

required.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, in accordance with AISI S240 and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install in accordance with Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, in accordance with Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 ft. and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative errors are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION OF COLD-FORMED STEEL FRAMING

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing in accordance with ASTM C1007, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install in accordance with Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

D. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

E. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

G. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous track sized to match studs. Align track accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection track and anchor to building structure.
2. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel U-channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Install continuous track sized to match studs. Align track accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of

vertical loads while providing lateral support.

1. Install single deep-leg deflection track and anchor to building structure.
2. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at 96-inch centers.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION OF JOIST FRAMING

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing as indicated on Shop Drawings.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches from abutting walls, and as follows:

1. Joist Spacing: As indicated on Drawings.

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 ft. and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.8 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint in accordance with ASTM A780/A780M and manufacturer's written instructions.

3.9 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous framing and supports.
2. Miscellaneous steel trim.
3. Metal bollards.
4. Ship’s Ladder.

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

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

C. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 05 12 00 "Structural Steel Framing" for steel framing, supports, door frames, and other steel items attached to the structural-steel framing.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Fasteners.
2. Shop primers.
3. Shrinkage-resisting grout.

4. Slotted channel framing.
5. Metal bollards.
6. Ship's Ladder

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Miscellaneous framing and supports for applications where framing and supports are not specified in other Sections.
2. Metal bollards.
3. Loose steel lintels.
4. Ship's Ladder

C. Samples for Verification: For each type and finish of extruded nosing.

D. Delegated Design Submittals: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following welding codes:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.5 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Structural framing and treads must support a minimum concentrated live load of 1,000 pounds, or a uniform load of 100psf.

2.2 METALS

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

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled-Stainless Steel Floor Plate: ASTM A793.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8-inches.
2. Galvanized Steel: ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
3. Cold-Rolled Steel: ASTM A1008/A1008M, structural steel, Grade 33 minimum thickness; hot-dip galvanized after fabrication.

J. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

K. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless steel fasteners for fastening aluminum and stainless steel.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, 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 in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

G. Post-Installed Anchors: Torque-controlled expansion anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8-inches by length indicated with anchor straps or studs not less than 3-inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer that contains pigments that make it easily distinguishable from zinc-rich primer.

B. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

F. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3,000 psi.

2.5 FABRICATION, GENERAL

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

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32-inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2-inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8-inches from ends and corners of units and 24-inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 for fixed ladders and OSHA 1910.25 / IBC 1011.15 for ship's ladders.

B. Fixed Steel Ladders:

1. Space siderails 18-inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch- diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Source Limitations: Obtain nonslip surfaces from single source from single manufacturer.
7. Support each ladder at top and bottom and not more than 60-inches o.c. with welded or bolted steel brackets.
8. Galvanize and prime ladders, including brackets.
9. Prime ladders, including brackets and fasteners, with zinc-rich primer.

C. Ship's Ladders:

1. Material: Structural aluminum alloy (6005-T5) or carbon steel / stainless steel frame construction.
2. Stringers: Formed channel sections, minimum 5-inches by 2-inches by 3/16-inch thick.
3. Treads: Deeply serrated non-slip surface, minimum 4- to 5-inches deep, with a clear width of 20- to 24-inches. Pitch to be set between 50- and 70-degrees from horizontal.
4. Handrails: Dual side handrails constructed from 1-1/4-inch to 1-1/2-inch diameter schedule 40 pipe, positioned 30- to 34-inches above the tread nosing.

2.8 ELEVATOR PIT SUMP COVERS

A. Fabricate from 3/16-inch rolled-steel floor plate with four 1-inch-diameter holes for water drainage and for lifting.

B. Provide steel angle supports unless otherwise indicated.

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 stainless steel, No. 4/180-grit finish.

1. Cap bollards with 1/4-inch- thick, stainless steel, ASTM A480/A480M, No. 4 finish plate with flat top.
2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8-inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.12 STEEL WELD PLATES AND ANGLES

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

2.13 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with universal shop primer unless zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
4. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

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

B. Anchor supports for operable partitions, overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Anchor shelf angles securely to existing construction with expansion anchors, anchor bolts and/or through bolts.

3.3 INSTALLATION OF SHELF ANGLES

A. Install shelf angles as required to keep masonry level, at correct elevation, and flush with vertical plane.

3.4 INSTALLATION OF METAL LADDERS

A. Secure ladders to adjacent construction with the clip angles attached to the stringer.

B. Install brackets as required for securing of ladders welded or bolted to structural steel or built into masonry or concrete.

C. Verify that structural anchor supports and opening dimensions are ready and level prior to installation.

D. Securely anchor stringers to top floor slabs and lower base foundations using manufacturer-approved expansion or welded connection plates.

E. Verify handrail rigidity, check that all bolted or welded connections are secure, and clean metal surfaces free of operational scuffs or debris.

3.5 INSTALLATION OF ELEVATOR PIT SUMP COVERS

A. Install tops of elevator sump pit cover plates and frames flush with finished surface. Adjust as required to avoid lippage that could present a tripping hazard.

3.6 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 42-inches deep and 3/4-inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8-inch toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

3.7 REPAIRS

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood products.
2. Wood-preservative-treated lumber.
3. Fire-retardant-treated lumber.
4. Miscellaneous lumber.
5. Plywood backing panels.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 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 materials comply 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 materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For preservative-treated wood products. Indicate type of preservative used and net amount of preservative retained.

1.4 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. 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.

B. Maximum Moisture Content:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1, Use categories as follows:

1. UC2: Interior construction not in contact with ground but may be subject to moisture.
2. UC3B (Commodity Specification A): Uncoated sawn products in exterior construction not in contact with ground, exposed to all weather cycles including intermittent wetting but with sufficient air circulation for wood to dry. Excludes sawn products not in contact with ground but with ground contact-type hazards.
3. UC4C for items in contact with the ground.
4. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all rough carpentry unless otherwise indicated.

2.3 FIRE-RETARDANT-TREATED LUMBER

A. General: Where fire-retardant-treated materials are indicated, materials are to comply 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 Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, 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. Treatment is not to promote corrosion of metal fasteners.
2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.

E. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:

1. Mixed southern pine or southern pine; SPIB.

C. Roofing Nailers: Structural- or No. 2-grade lumber or better; kiln-dried Douglas fir, southern pine, or wood having similar decay-resistant properties.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners are to be of size and type indicated and 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 into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58 as appropriate for the substrate.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025-inch.

B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

C. Provide blocking and framing as indicated and as required to support facing materials,

fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16-inches o.c.

D. 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 member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

H. Securely attach roofing nailers to substrates by anchoring and fastening to withstand bending, shear, or other stresses imparted by Project wind loads and fastener-resistance loads as designed in accordance with ASCE/SEI 7.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach wood blocking to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Attach wood roofing nailers securely to substrate to resist the designed outward and upward wind loads indicated on Drawings and in accordance with ANSI/SPRI ED-1, Tables A6 and A7.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 16 43 - GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes wall sheathing.

B. Related Sections:
   1. Wall framing is specified in Division 5 section, Cold-formed Metal Framing.
   2. Water and air barrier treatment is specified in Division 7 section.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Store and handle panels in accordance with manufacturer's instructions.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical sheets for glass-mat gypsum sheathing, showing dimensions, thickness, and weight.

B. Certificates: Documentation providing compliance with ASTM C1177, plus mold resistance test results ASTM D3273

C. Fire Performance: Test data for surface burning characteristics ASTM E84 / ASTM E136 and UL Intertek fire-resistance design numbers for Type X.

1.4 QUALITY CONTROL AND INSTALLATION SUBMITTALS

A. Fastener data: Corrosion resistant screws matching ASTM C954.

B. Joint Treatment: Manufacturer's recommendations for joint reinforcing, and sealants.

PART 2 - PRODUCTS

2.1 SHEATHING

A. Glass-mat gypsum wall sheathing: ASTM-C 1177/1177M
   1. Type and thickness: Type X, 5/8-inch (15.9mm) thick.

B. Fasteners: Corrosion-resistant screw fasteners. Size and type recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that exclude exterior moisture.

B. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.
   1. Fasten gypsum sheathing to framing with screws.
   2. Install boards with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.
   3. Install boards with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials.

3.3 PROTECTION

A. Protect sheathing by covering exposed exterior surface of sheathing with weather-resistant sheathing paper securely fastened to framing.

B. Apply covering immediately after sheathing is installed.

END OF SECTION 06 16 43

SECTION 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic laminate clad cabinets, panels, and casework.
2. Shelving.
3. Solid surface countertops.
4. Cabinet and shelf hardware.
5. Interior standing and running trim for opaque finish.
6. Miscellaneous materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.

1.2 COORDINATION

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Plastic laminate faced cabinets and shelves.
2. Plastic laminate faced wood paneling.
3. Cabinet hardware and accessories.
4. Anchors.
5. Adhesives.
6. Solid surface.

B. Wood-Preservative Treatment:

1. Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings:

1. Include the following:
   a. Dimensioned plans, elevations, and sections.

b. Large scale details.
c. Attachment details.
d. Hardware.

2. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.

D. Samples for Verification of Selection: Submit manufacturer's samples for the following:
1. Plastic laminate
2. Solid surface
3. Hardware
a. Door / Drawer pulls
b. Hinges

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
2. Installer Qualifications: Licensed participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Architectural Woodwork Standards, Section 2.

B. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas.

C. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1. Handle and store fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions.

1.6 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction.

B. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate

measurements on Shop Drawings.

C. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

B. Design and Construction Features: Comply with details shown for profile and construction of architectural woodwork; and, where otherwise not shown, comply with applicable Quality Standards, with alternate details as Fabricator's option.

C. Pre-cut Openings: Fabricate architectural woodwork with pre-cut openings, where possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape. Smooth edges of cutouts, and, where located in countertops and similar exposures, seal edges of cutouts with a water-resistant coating.

D. Measures: Before proceeding with fabrication of woodwork to be fitted to other construction, obtain measurements and verify dimensions and shop drawing details for accurate fit. Where sequence of measuring substrates before fabrication would delay the project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming of woodwork for accurate fit.

1. AWI Premium grade.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Architectural Woodwork Standards Grade: Premium.

1. Wood Species: Any closed-grain hardwood.
2. Wood Moisture Content: 8 to 13 percent.

2.3 PLYWOOD

A. General: Lumber, or veneer core construction (particleboard not permitted) with standard odd number of plies for thickness indicated. Backing of any hardwood compatible face species. 4' x 8' nominal panel size. Polish sanded finish.

B. Opaque finish: Any close-grained paint grade specie, but do not use pine. Premium grade for opaque paint finish and premium grade for locations not requiring paint finish.

C. Exposed Edges: Provide 1/2-inch solid stock lumber hardwood edge band treatments in compliance with AWI standards. Match wood specie and cut for appearance.

2.4 ACRYLIC SOLID SURFACE COUNTERTOPS

A. Acrylic solid surface:

1. Color / Pattern: As indicated in the Drawings.
2. Products: Basis-of-Design, **Wilsonart** or approved equal.

B. Joint Adhesive and Sealants: As recommended by solid surface manufacturer. Color-matched to countertop.

C. Fabrication: Fabricate components in shop to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings.

1. Form joint seams between solid surface components with manufacturer's seam adhesive. Complete joint inconspicuous in appearance and without voids.
2. Provide joint reinforcing if required by manufacturer for particular installation conditions.
3. Provide holes and cutouts for plumbing fixtures and accessories indicated on approved shop drawings. Rout cutouts and finish edges smooth.

2.5 PLASTIC LAMINATE FACED WOOD PANELING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design, Wilsonart**.

1. Formica
2. Nevamar
3. Abet Laminati

B. Panel Materials: High-pressure decorative laminate (HPL) complying with NEMA LD 3, Grade HGS or Grade HVS.

1. Color / Pattern: As indicated in the Drawings.
2. Finish: Matte
3. Core Material: 5-ply hardwood plywood. Thickness 1/2-inch.
4. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
   a. Horizontal Surfaces other than Tops: Grade HGS
   b. Postformed Surfaces: Grade HGP
   c. Vertical Surfaces: Grade VGS
   d. Edges: Grade HGS

C. Fabrication:

1. Adhesive: PVA, Type II water-resistant wood glue or rigid polyurethane adhesive.
2. Lamination: Cold or hot-pressed under pressure to the plywood core to guarantee a 100% permanent flat bond.

3. Edge Treatment: As indicated in the Drawings, or if not indicated, self-edged plastic laminate.

2.6 CABINETS AND SHELVING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design, Wilsonart**.

1. Formica
2. Nevamar
3. Abet Laminati

B. Plastic-Laminate Clad Cabinets: Provide at locations indicated.

1. AWI Type of Cabinet Construction: Full overlay, unless indicated otherwise.
2. Reveal Dimension: 1/2-inch.
3. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate as follows:
   a. Horizontal Surfaces other than Tops: Grade HGS
   b. Postformed Surfaces: Grade HGP
   c. Vertical Surfaces: Grade VGS
   d. Edges: Grade HGS
4. Materials for Semi-exposed Surfaces other than Drawer Bodies: Plywood.
5. Drawer Sides and Backs: Plywood.
6. Drawer Bottoms: Plywood.
7. Colors / Patterns: See Drawings.
8. Finish: Matte.

C. Fabrication: Fabricate cabinets and shelving as indicated:

1. Shelving: Fabricate supporting sides with 5/4-inch-thick plywood.
2. Open Shelving: Fabricate exposed faces with specified plywood, with matching solid stock trim and edges.
3. Where shelves span 28-inches or more, provide 1x2 edging at each long edge of shelf.
4. Enclosed Interiors of Cabinets, Drawers, and Shelving: Fabricate with plywood. Where indicated, provide solid stock wood edge trim at shelving.
5. Edging:
   a. Open Shelving: solid stock wood edges.
   b. Enclosed Shelving: 3mm PVC edge band.

D. Cabinet and Shelf Hardware: Satin chrome finish, unless noted otherwise.

1. Drawer Glides: Epoxy coated paint finish cold-rolled steel construction with solid acetate roller. Positive stop with lift-out disconnect. 8400 by Knape & Vogt, or approved equal.
2. Shelf Supports: Zinc-coated steel, recessed mount, 255ZC standards and zing-coated steel 256ZC supports by Knape & Vogt or approved equal.
3. Cabinet Door Hinges:
   a. Base and Wall Cabinets (units less than 4-feet tall): Self-closing, 120-

degree opening swing, heavy duty ‘European’ type concealed hinges series 90 by Blum, Hafele, or Sugatsune.

b. Wall Cabinets (units more than 4-feet tall): Continuous stainless steel piano hinge, heavy gauge, 16-gage minimum.

4. Cabinet Door and Drawer Pulls:

a. 3/4-inch center round tubular pull (as shown below).
b. Satin chrome / stainless steel finish.
c. Liberty, Trimco, Brainerd, Rockwood, or approved equal.



2.7 MISCELLANEOUS MATERIALS

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

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.

a. Provide where indicated.
b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage.

1. Provide metal expansion sleeves or expansion bolts for post-installed anchors.
2. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Adhesives: Product recommended by fabricator for each substrate for secure anchorage.

1. Do not use adhesives that contain urea formaldehyde.

2.8 FABRICATION

A. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated.

1. Ease edges to radius indicated for the following:
    a. Edges of Solid-Wood (Lumber) Members: 1/16-inch unless otherwise indicated.

B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site.

1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled.
    a. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting.
    b. Verify that parts fit as intended, and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to humidity conditions in installation areas for not less than 72 hours prior to beginning of installation.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming of concealed surfaces.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed during shop fabrication.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion.

1. Shim as required with concealed shims.
2. Install level and plumb to a tolerance of 1/8-inch in 96-inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates.

1. Secure with countersunk, concealed fasteners and blind nailing.
2. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with interior architectural woodwork.
3. For shop-finished items, use filler matching finish of items being installed.

F. Standing and Running Trim:

1. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible.
2. Do not use pieces less than 60-inches long, except where shorter single-length pieces are necessary.
3. Scarf running joints and stagger in adjacent and related members.
4. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished.
5. Install standing and running trim with no more variation from a straight line than 1/8-inch in 96-inches.

3.3 REPAIR

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects and to result in interior architectural woodwork being in compliance with requirements of Architectural Woodwork Standards for the specified grade.

B. Where not possible to repair, replace defective woodwork.

C. Field Finish: See Section 099123 "Interior Painting" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.4 CLEANING

A. Clean hardware. Lubricate and make adjustments for proper operation.

B. Clean interior architectural woodwork on exposed and semi-exposed surfaces.

C. Clean countertops according to countertop manufacturer’s maintenance instructions.

3.5 CABINET AND SHELOF HARDWARE SCHEDULE:

A. Pulls: One per cabinet door and one per drawer.

B. Drawer Glides: 2 per drawer.

C. Cabinet Door Hinges:

1. Base and Wall Cabinets (less than 4-feet tall): Minimum one pair per door.

Additional where weight of door exceeds hinge manufacturer's recommendations.

2. Wall Cabinets (more than 4-feet tall): Continuous stainless steel piano hinge. Fasten each side to door and cabinet with stainless steel fasteners at not more than 6-inch centers.

D. Door and Drawer Bumpers:

1. Standard Cabinet Doors: 2 minimum, one in the upper corner near the latch edge and one in the lower corner.
2. Standard Drawers: 2 minimum, on the left and right upper or lower inside corners of the drawer front frame.
3. Large or Heavy Duty Doors and Drawers: 4 bumpers, minimum, on all 4 corners
4. Size: Standard 1/2-inch diameter and thickness of 1/8-inch.
5. Material: clear polyurethane or rubber stick-on pads.

E. Shelf Supports:

1. Stainless steel shelf pins – 4 supports per shelf.
2. Where indicated: 4 shelf standards per shelf, with 4 shelf supports x number of shelves indicated per shelf compartment unit.

END OF SECTION 06 40 23

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Polyisocyanurate foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

C. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

D. Thermal-Resistance Value (R-Value): R-value in accordance with ASTM C518.

2.2 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.

1. Basis for Design Product: Subject to compliance with requirements, provide Atlas Polyiso Roof and Wall Insulation, EnergyShield Pro or equal products by one of the following:

    a. Carlisle Coatings & Waterproofing Inc
    b. Johns Manville; a Berkshire Hathaway company
    c. Rmax, A Business Unit of Sika Corporation

2. R-Value: R 6.5 minimum.
3. Thickness: 1.0 inches

2.3 GLASS-FIBER BLANKET/BATT INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed; SAINT-GOBAIN
    b. Johns Manville; a Berkshire Hathaway company
    c. Knauf Insulation
    d. Owens Corning

2. R-Value/Thickness

    a. R-19 Minimum/6 inches
    b. R-11 Minimum/3-1/2 inches
    c. R-38 Minimum/ 2 layers 6 inches

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Miscellaneous Application Accessories:

1. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
2. Crack Sealer: Closed-cell insulating foam in aerosol dispenser recommended in writing by insulation manufacturer for filling gaps in board insulation.
3. Detailing Foam Insulation for Voids: Urethane foam complying with AAMA 812, low expansion pressure suitable for filling insulation gaps and voids adjacent to openings to protect against water, air, and sound intrusion.
4. Wire Mesh Lath Support for Insulation: ASTM C1032.

    a. Material: Woven wire lath 1-1/2-inch hexagonal-shaped mesh with minimum 0.0510-inch- diameter, galvanized-steel wire.

5. Tapes for Reflective Insulation and Barriers:

    a. Aluminum-foil tape for repairs or splicing material.
    b. Double-sided tape for adhering to metal framing or overlapping material.
    c. Reinforced-foil tape for sealing tears or cuts in sheet vapor barrier.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended in writing by manufacturer.

1. Fit courses of insulation between Z-shaped furring as specified in Section 092216 “Non-Structural Metal Framing. Fit tight to obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install between roof framing members in insulated attic spaces. Use wire mesh to support from roof framing above.
5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

3.6 PROTECTION

C. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

D. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Medium-build air barriers, vapor permeable.

1.2 DEFINITIONS

A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.

1. Protect substrates from environmental conditions that affect air-barrier performance.
2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain primary air-barrier materials and air-barrier accessories from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference; ASTM E2178.

D. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested in accordance with ASTM D4541.

F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

G. UV Resistance: Can be exposed to sunlight for 180 days in accordance with manufacturer's written instructions.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 16 to 34 mils over smooth, void-free substrates.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies Inc; Perm-A-Barrier VPL or comparable product by one of the following:

    a. Carlisle Coatings & Waterproofing Inc
    b. Henry, a Carlisle Company (formerly Henry Company and Carlisle Coatings & Waterproofing Inc. brands)
    c. Tremco Incorporated
    d. W. R. Meadows, Inc

2. Vapor Permeance: Minimum 5 perms; ASTM E96/E96M, Procedure B, Water Method.

2.4 ACCESSORY MATERIALS

A. Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

1. Transition Membrane: Perm-A-Barrier NPS Detail Membrane; a self-adhered membrane that does not require a primer fabricated in various widths for detail areas conforming with the following:

a) Puncture Resistance: ASTM E154: Min. 40 lbs. (178 N)
b) Pliability, Low Temperature Flexibility ASTM D1970: Pass at -20F (-29C)
c) Tensile Strength: ASTM D412: Min. 400 psi (2.8 MPa)
d) Elongation: ASTM D412: Min. 200%

2. Flexible Membrane Wall Flashing: Perm-A-Barrier Wall Flashing; a 32 mil (0.8 mm) of self-adhesive rubberized asphalt integrally bonded to 8 mil (0.2 mm) of cross-laminated, high-density polyethylene film to provide a min. 40 mil (1.0 mm) thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed, conforming with the following:

a) Puncture Resistance: ASTM E154: Min. 80 lbs.(356 N)
b) Pliability, Low Temperature Flexibility: ASTM D1970: Pass at -45F (-43C)
c) Tensile Strength: ASTM D412, Die C Modified: Min. 1,200 psi (8.3 MPa)
d) Elongation: ASTM D412, Die C: Min. 200%

B. Primer: Liquid [waterborne][solvent-borne] primer recommended for substrate by air-barrier material manufacturer.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch thick, and Series 300 stainless steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
3. Verify that substrates are visibly dry and free of moisture.
4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF ACCESSORIES

A. Install accessory materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.

1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.

1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

H. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

I. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 INSTALLATION OF PRIMARY AIR-BARRIER MATERIAL

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier in accordance with air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.

1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.

1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness fo 25 mils as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections will include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Air-barrier dry film thickness.
3. Maximum exposure time of materials to UV deterioration has not been exceeded.
4. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
5. Strips and transition strips have been firmly adhered to substrate.
6. Transitions at changes in direction and structural support at gaps have been provided.
7. All penetrations have been sealed.

D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, in accordance with manufacturer's written instructions, where inspection results indicate insufficient thickness.

E. Prepare and submit inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION 072726

SECTION 07 41 01 - (ARCHITECTURAL) STANDING SEAM METAL ROOF SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Standing-seam metal roof panel assembly, for installation on sheathing substrate.
   2. Fascia.
   3. Soffit.

B. Related Sections:
   1. Division 6 Section "Rough Carpentry" for plywood roof sheathing.

1.2 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, and accessories necessary for a complete weathertight roofing system.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class, for wind load as indicated in the drawings. .

C. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings: Show fabrication and installation layouts of metal roof panels; details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, trim, flashings, closures, and accessories, roof penetrations, and special details. Distinguish between factory- and field-assembled work.
   1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches (1:10):
      a. Flashing and trim.

C. Samples for Verification of Selection:
   1. Roof Panels: Submit sample for verification of color selection.
   2. Soffit: Submit sample for verification of match with each color selection, and for special colors / textures as indicated.

D. Warranties: Samples of manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain metal roof panels from single source from single manufacturer.

C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Build mockup of typical roof eave, including fascia, and roof fold-over edge as shown on Drawings; approximately four panels wide by full eave width, including underlayment, attachments, and accessories.
   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. Approved mockups may not become part of the completed.

D. Pre-installation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal roof panel Installer, metal roof panel manufacturer's representative, deck Installer, and installers whose work interfaces with or affects metal roof panels including installers of roof accessories.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal roof panel installation, including manufacturer's written instructions.
   4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   5. Review structural loading limitations of deck during and after roofing.
   6. Review flashings, special roof details, roof drainage, roof penetrations, and condition of other construction that will affect metal roof panels.
   7. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
   8. Review temporary protection requirements for metal roof panel assembly during and after installation.
   9. Review roof observation and repair procedures after metal roof panel installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Protect strippable protective covering on metal roof panels from exposure to sunlight and high humidity, except to extent necessary for period of metal roof panel installation.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate sizes and locations of roof penetrations.

B. Coordinate metal roof panels with rain drainage work, flashing, trim, and construction of decks and other adjoining work to provide a leakproof, secure, and non-corrosive installation.

1.9 ROOF INSTALLER ROOF SERVICE GUARANTEE

A. Roof Service Guarantee: The roof installer shall furnish the Owner a roof service guarantee against leaks from faulty or defective materials and workmanship for a period shown on the guarantee, starting on the date of the Owner’s Final Acceptance of the project.
   1. Form: Service guarantee shall be in the exact form attached at the end of this Section.
   2. Number of Copies: Submit 2 copies, with original signatures by all parties.
   3. Separate Guarantees for each building.

1.10 MANUFACTURER WARRANTIES

A. Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 40 years from date of Substantial Completion.

B. Weathertightness Warranty for Standing-Seam Metal Roof Panels: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. One of the following metals:
      a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
      b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
   2. Surface: Smooth.
   3. Exposed Coil-Coated Finish:
      a. Fluoropolymer: AAMA 621. Minimum 2-coats, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   4. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil (0.013 mm).

B. Panel Sealants:
   1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
   2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.
   3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.2 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: 30 to 40 mils (0.76 to 1.0 mm) thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at 240 deg F (116 deg C); ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
   3. Products: Subject to compliance with requirements, provide one of the following, but are not limited to, the following:
      a. Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
      b. Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.

c. Henry Company; Blueskin PE200 HT.
d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal roof panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

B. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

C. Pipe Penetration Flashings: Manufacturer's fabricated EPDM or Neoprene boots, with related seal components.

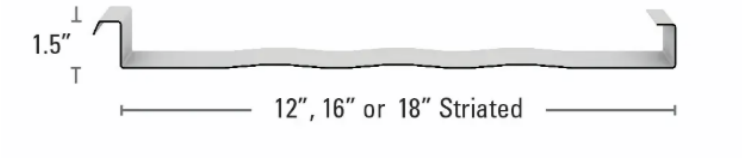
2.4 (ARCHITECTURAL) STANDING-SEAM METAL ROOF PANELS

A. Description: Factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Factory formed 12-inch wide, 24-gage galvanized pre-finished standing seam panels, with 1-3/4-inch high standing seams.
   2. Roof panels continuous from eave to ridge.
   3. Integral continuous interlocking standing seam, without separate seam covers.
   4. Factory installed, high grade, hot-melt elastomeric sealant, within the confines of female seam flange, on bottom edge of female seam leg, designed to seal against adjacent male panel leg.
   5. Clips: UL listed clip designed to allow thermal movement in panels. 18 gage galvanized steel concealed clip. Double fasten each clip. Screw fasten to substrate.

B. Integral-Standing-Seam Metal Roof Panels: Formed with integral ribs at panel edges and between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.
   1. Basis of Product Selection: **Maxima Standing Seam Roof Panel by McElroy Metals**.
      a. Subject to compliance with requirements, provide equivalent products by other manufacturers or approved equal:
         1) ATAS International, Inc.
         2) Fabral.
         3) MBCI
         4) Berridge
         5) Petersen Aluminum Corporation.
   2. Steel Sheet: 24 gage minimum thickness. One of the following metals:

a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.

3. Clips: Minimum 18 gage zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet.
4. Panel Coverage and Seam Configuration: 12 inches wide panel, with 1-1/2-inch high x 3/8-inch wide standing seams.



5. Surface: Smooth.
6. Color: Matching Owner's existing color on campus - **Patina Green** by McElroy Metal, or color match.

2.5 METAL SOFFIT PANELS

A. General: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels (**SFT-1** and **SFT-2**): Solid panel formed with a inverted plank pan, between panel edges; with a flush joint between panels.



1. Material: Same material as metal roof panels.
   a. Provide non-perforated metal panels over porches.
2. Color:
   a. Matching Owner's existing color on campus - **Patina Green** by McElroy Metal, or color match.
   b. Wood Grain – **Golden Pecan** by McElroy Metal, or color match.
3. Basis-of-Design Product: **FW Concealed Fastened Metal Soffit Panel by McElroy**.
   a. Subject to compliance with requirements, provide equivalent products by other manufacturers or approved equal:
      1) ATAS International, Inc.
      2) MBCI
      3) Berridge
      4) Petersen Aluminum Corporation

4. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated

steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

a. Thickness: 0.024 inch.
b. Exterior Finish: Two-coat fluoropolymer.
c. Color **SFT-1**: **Patina Green** by McElroy Metal, or color match.
d. Color **SFT-2**: **Wood Grain – Golden Pecan** by McElroy Metal, or color match.
e. Color **SFT-3: Color selected from manufacturer's full range**.

5. Panel Coverage: 12 inches.
6. Panel Height: 1.5 inches.
7. Reveal: 1-inch

2.6 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
   2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
   3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Flashing and Trim: Formed from same material as roof panels. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal roof panels.

2.7 FABRICATION

A. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

D. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. End Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

2.8 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of the Work.

B. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

C. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

D. Make corrections to unsatisfactory conditions.

3.2 PREPARATION

A. Miscellaneous Framing: Install furring, and other miscellaneous support members and anchorage.

B. Soffit Framing: Wire tie or fasten furring channels to roof joist framing. Space furring channels 12-inches centers.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below and on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Roof perimeter for a distance up from eaves of 24 inches (600 mm) beyond interior wall line.
   2. Valleys, from lowest point to highest point, for a distance on each side of 18 inches (460 mm). Overlap ends of sheets not less than 6 inches (150 mm).
   3. Rake edges for a distance of 18 inches (460 mm).
   4. Hips and ridges for a distance on each side of 12 inches (300 mm).
   5. Around dormers, and other penetrating elements for a distance from element of 18 inches (460 mm).

B. Install flashings to cover underlayment to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.4 METAL ROOF PANEL INSTALLATION

A. Provide metal roof panels of full length from eave to ridge.

B. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Pre-drill panels for fasteners.
   1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge.
   2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal movement.

C. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   1. Install metal roof panel in accordance with manufacturer’s instructions.
   2. Field cutting of metal panels by torch is not permitted.
   3. Install panels with seams running in the direction of the roof slope.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Provide metal closures at each side of ridge and hip caps.
   6. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
   7. Install ridge and hip caps as metal roof panel work proceeds.

8. Install metal flashing to allow moisture to run over and off metal roof panels.

D. Fasteners:
   1. Steel Roof Panels: Use stainless-steel fasteners for surfaces exposed to the exterior and galvanized-steel fasteners for surfaces exposed to the interior.

E. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.
   1. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

G. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
   1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.

3.5 METAL SOFFIT PANEL INSTALLATION

A. In addition to complying with requirements in "Metal Roof Panel Installation, General" Article, install metal soffit panels to comply with requirements in this article.

B. Metal Soffit Panels: Provide metal soffit panels full width of soffits. Install panels perpendicular to support framing with concealed fasteners. Fasten to furring. Apply screws to concealed leg flange of each panel.
   1. Flash and seal panels with weather closures where metal soffit panels meet walls and at perimeter of all openings.

C. Metal Fascia Panels: Align bottom of panels and fasten with blind rivets, bolts, or self-tapping screws. Flash and seal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

3.6 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
   1. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated.

Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.7 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.8 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal roof panel installation, clean finished surfaces as recommended by metal roof panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal roof panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 01

ROOFING GUARANTEE R-3 (Standing Seam Metal Roof System)

BUILDING NAME & OWNER:

- (NAME OF SCHOOL) –
- ADDRESS -

Whereas (name of roofer) _____

Address _____ Telephone: (___) _____
herein called the Contractor, has provided pre-formed, pre-finished metal roofing, flashing, accessories and miscellaneous items required for a complete roof system installation in accordance with the Contract Documents for the PROJECT:

Name of Project: _____

Location/Address: _____

Name and Type of Building(s): _____

_____

Type of System: Standing Seam Metal Roof System

Total Roof Area: _____ SF; Total Length of Ridge _____LF ;

Total Length of rake: _____LF; Total Length of eave _____LF

Date of Acceptance _____

Two year Guarantee Expiration _____

AND WHEREAS the Contractor has contracted to guarantee said work against water entry from faulty or defective materials and workmanship for the designated Guarantee period of TWO (2) YEARS from the date of the Final acceptance of the Project;

NOW THEREFORE the Contractor guarantees, subject to the terms and conditions herein set forth, that during the Guarantee Period the Contractor will at his own cost and expense, make or cause to be made with approved procedures and materials such repairs to or replacements of said work (including any wetted thermal insulation) resulting from water entry or faults or defects of said Work as are necessary to maintain said Work in watertight conditions and further, respond on or within TWO (2) working days upon written notification of leaks or defects by the Owner/User Agency.

This Guarantee is made subject the following terms and conditions

1. Specifically excluded from this guarantee are damages to the Work, other parts of the building(s) and building contents caused by: A) lighting; windstorm (including hurricanes and tornadoes), hailstorm, earthquake and other unusual phenomena of the elements; B) fire; and C) structural failures causing excessive roof deck, edges and related roof component movement. When the Work has been damaged by any of the foregoing causes, the Guarantee will be suspended until such time as the damage has been repaired, and until the cost and expense thereof has been assigned or paid by the Owner or the responsible party. The guarantee shall be reinstated upon Final Acceptance of the damage repair Work by both the Owner & Contractor.

2. During the Guarantee Period, if the Owner/ User Agency allows alteration of the Work by anyone other than a Contractor approved in writing by the original Contractor and/or Roofing Material Supplier prior to the work being performed, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything (i.e. signs) onto the roof, this Guarantee shall become null and void as of the date of said alterations. If the Owner/ User Agency engages the original Contractor for said alterations, the Guarantee shall be maintained in force unless the Contractor presents written notification to the Owner that the intended work will likely damage or cause deterioration of the base work, thereby justifying a termination of the original Guarantee.

3. The Owner/User Agency shall promptly notify the Contractor in writing of observed, known or suspected leaks. defects or condition deterioration and shall afford a reasonable opportunity for the Contractor to inspect the work and examine evidence of such leaks, defects or deterioration .

4. This Guarantee is recognized to be the only guarantee of the Contractor of said work, and shall not operate to restrict or cut-off the Owner from any other remedies and recourse lawfully available to him in case of roofing failure to any cause or degree. Specifically, this Guarantee shall not operate to relieve the Contractor of his responsibility for the performance of the original work.

IN WITNESS THEREOF, this instrument has been duly executed
this _____day of _____, 20____.

Contractor's Signature: _____

Typed Name: _____

Telephone Number _____

WITNESS: _____

And if applicable, is countersigned by the following Sub Contractor, Installer, or other party (as indicated) who acted as agent or represented the Contractor during the performance of the work:

Countersignee Name: _____
(*Type or Print)*
Date: _____ Signature: _____

Representing: _____

Address: _____

_____

Telephone Number: _____

Witness: _____

SECTION 07 42 13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concealed-fastener, lap-seam metal wall panels.

B. Related Requirements:

1. Section 07 41 01 "Architectural Standing Seam Metal Roof System" for metal-roof panels and soffits.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
2. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
4. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

1. Concealed-fastener, lap-seam metal wall panels.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12-inches long by actual panel width.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For concealed-fastener, lap-seam metal wall panels, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

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

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Wide Reveal-Joint, Concealed-Fastener Metal Wall Panels (**MTL-1**): Formed with horizontal panel edges and a stepped profile between panel edges, resulting in a wide reveal joint between panels.

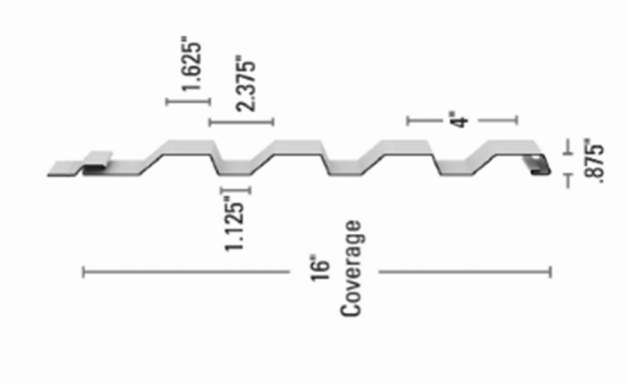
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design: Wave Concealed Fastened Panel Metal Wall System, by McElroy Metal**.

   a. MBCI
   b. Berridge
   c. Morin - A Kingspan Group Company
   d. PAC-CLAD; Petersen; a Carlisle company
   e. Or Prior Approved Equal.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

   a. Nominal Thickness: 0.022 inch.
   b. Exterior Finish: Two-coat fluoropolymer.
   c. Color(s): **Selected from manufacturer's full range**.

3. Panel Coverage: 16 inches.
4. Panel Height: 7/8-inch.



C. Board and Batten, Concealed-Fastener Metal Wall Panels (**MTL-2** and **MTL-3**): Formed with vertical panel edges and a stepped profile between panel edges, resulting in a raised batten joint between panels.

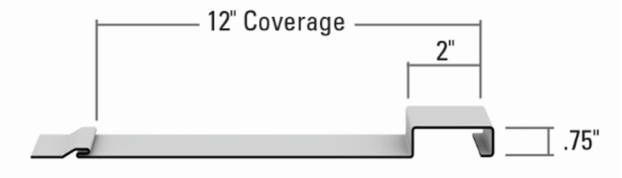
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design: Nostalgia Board and Batten Concealed Fastened Batten Wall System, by McElroy Metals.**

    a. MBCI
    b. Berridge
    c. Morin - A Kingspan Group Company
    d. PAC-CLAD; Petersen; a Carlisle company
    e. Or Prior Approved Equal.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Thickness: 0.024 inch.
    b. Surface: stucco embossed finish
    c. Exterior Finish: Two-coat fluoropolymer.
    d. Color **MTL-2**: Matching Owner's existing color on campus - **Patina Green** by McElroy Metal, or color match.
    e. Color **MTL-3**: **As selected from manufacturer's full range**.

3. Panel Coverage: 12 inches.
4. Panel Height: 0.75 inches.



D. Plank, Concealed-Fastener Metal Wall Panels (**MTL-4**):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design: FW Concealed Fastened Metal Wall Panel by McElroy Metals.**

    1) ATAS International, Inc.
    2) MBCI
    3) Berridge
    4) Petersen Aluminum Corporation

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

    a. Thickness: 0.024 inch.
    b. Exterior Finish: Two-coat fluoropolymer.
    c. Color(s): **Wood Grain – Golden Pecan** by McElroy Metal, or color match.

3. Panel Coverage: 12 inches.
4. Panel Height: 1.5 inches.
5. Reveal: 1-inch



2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure

strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

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

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie **or clip** furring channels to supports**, as required to comply with requirements for assemblies indicated**.

3.3 INSTALLATION OF METAL WALL AND SOFFIT PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13

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

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic polyolefin (TPO) roofing system.
   2. Accessory roofing system materials.

B. Related Requirements:
   1. Section 06 16 00 "Sheathing" for wood-based, structural-use roof deck panels.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's " Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

C. Samples: Roofing membrane and flashings, of color required.

D. Wind-Uplift-Resistance Submittal: For roofing system indicating compliance with wind-uplift performance requirements.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:
   1. Performance Requirement Certificate: Signed by roofing membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
      a. Submit evidence of compliance with specified performance requirements.
   2. Special Warranty Certificate: Signed by roofing membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For roofing membrane and insulation, tests performed by an independent qualified testing agency indicating compliance with specified requirements.

C. Research Reports: For components of roofing system, from an agency acceptable to authorities having jurisdiction showing compliance with specified performance requirements.

D. Qualification Data: For roofing system Installer.

E. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is listed in SPRI's "Directory of Roof Assemblies" for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, certified, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing system materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
   1. Protect stored liquid material from direct sunlight.
   2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Handle and store roofing system materials, and place equipment in a manner to avoid permanent deflection of deck.

1.8 FIELD CONDITIONS

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

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty to include all components of roofing system, such as fasteners, adhesives, roofing membrane, base flashing sheet, and other components of roofing system.
2. Warranty Period: 20 years from date of Substantial Completion.

B. Roofing System Installer's Warranty: Submit Roofing System Installer's warranty, on warranty form at end of this Section, signed by Roofing System Installer, covering the Work of this Section, including all components of roofing system, such as fasteners, adhesives, roofing membrane, base flashing sheet, and other components of roofing system.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain components for roofing system from roofing membrane manufacturer or manufacturer approved by roofing membrane manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing system and flashings to remain watertight.
1. Accelerated Weathering: Roofing membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roofing membrane to resist impact damage when tested in accordance with ASTM D3746/D3746M, ASTM D4272/D4272M, or the Resistance to Foot Traffic Test in FM Approvals 4470.

B. Material Compatibility: Roofing system materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience.

C. Wind-Uplift Resistance: Design roofing system to resist the following wind-uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:

D. FM Approvals' RoofNav Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: Class 1A-90.
2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 SH.

E. SPRI's "Directory of Roof Assemblies" Listing: Roofing membrane, base flashings, and component materials to comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and are listed in SPRI's "Directory of Roof Assemblies" for roof assembly identical for that specified for this Project.
   1. Wind-Uplift Load Capacity: 90 psf.

F. Exterior Fire-Test Exposure: Class A; for application and roof slopes indicated; when tested by a qualified testing agency in accordance with ASTM E108 or UL 790.
   1. Identify products with appropriate markings of applicable testing agency.

2.3 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING SYSTEM

A. TPO Roofing Membrane Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fabric-backed TPO sheet.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Carlisle Syntec Systems
      b. Johns Manville; a Berkshire Hathaway company
      c. Siplast
   2. Thickness: 60 mil, nominal.
   3. Exposed Face Color: White.

2.4 ACCESSORY ROOFING SYSTEM MATERIALS

A. General: Accessory materials as recommended in writing by roofing membrane manufacturer for intended use and compatible with other roofing system components.

B. Base and Sheet Flashings: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as roofing membrane.

C. Bonding Adhesive: Roofing membrane manufacturer's standard, water based.

D. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

E. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing system components to substrate; tested for required pullout strength, and acceptable to roofing membrane manufacturer.

F. Safety Accessories: Roofing membrane manufacturer's standard yellow seaming tape for designating safety perimeters and rooftop hazards.

G. Miscellaneous Accessories: As recommended in writing by roofing membrane manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Roofing System Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests in accordance with roofing system manufacturer's written instructions.
   1. Submit test result within 24 hours after performing tests.
      a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING SYSTEM, GENERAL

A. Install roofing system materials and components in accordance with roofing system manufacturer's written installation instructions, SPRI's "Directory of Roof Assemblies" listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.

C. Coordinate installation and transition of roofing system component serving as an air barrier with wall system air barrier specified under Section 072726 "Fluid-Applied Membrane Air Barriers."

D. Substrate-Joint Penetrations: Prevent adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.4 INSTALLATION OF TPO ROOFING MEMBRANE

A. Install roofing membrane over roof area for adhered application method in accordance with roofing system manufacturer's written installation instructions.

B. Unroll roofing membrane and allow it to relax before installing.

C. Start installation in presence of roofing system manufacturer's technical personnel.

D. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps. Apply roofing membrane with side laps shingled with slope of roof deck where possible.

E. Adhered Application: Apply bonding adhesive to substrate and underside of roofing membrane at rate required by manufacturer and allow to partially dry before installing roofing membrane. Do not apply to splice area of roofing membrane.
   1. In addition to adhering, mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roof area.

F. Seams and End Laps: Clean seam areas, overlap membrane, and hot-air-weld side seams and end laps of roofing membrane and sheet flashings to ensure a watertight installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roofing membrane and sheet flashings.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing membrane that do not comply with requirements.

G. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing membrane in place with clamping ring.

3.5 INSTALLATION OF BASE AND SHEET FLASHINGS

A. General: Install and adhere base and sheet flashing and preformed flashing accessories to substrates in accordance with roofing system manufacturer's written installation instructions.

B. Apply bonding adhesive to substrate and underside of flashings at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners.

D. Clean seam areas, overlap, and firmly roll flashings into the adhesive. Hot-air-weld side seams and end laps to ensure a watertight installation.

E. Terminate and seal top of flashings and mechanically anchor to substrate through termination bars.

3.6 PROTECTING AND CLEANING

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

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.7 ROOFING SYSTEM INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing System Installer," has performed roofing and associated Work on the following Project:

1. Owner: <Insert name of Owner>.
2. Owner Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Building Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: _____.
7. Warranty Period: Two years from date of Substantial Completion.
8. Date of Substantial Completion: _____.

B. AND WHEREAS Roofing System Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing System Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing System Installer's own cost and expense, make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective work and as are necessary to maintain said Work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, caused by:

    a. lightning;
    b. peak gust wind speed exceeding <Insert mph>;
    c. fire;
    d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the Work;
    f. vapor condensation on bottom of roofing; and
    g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When Work has been damaged by any of foregoing causes, Warranty will be null and void until such damage has been repaired by Roofing System Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing System Installer is responsible for damage to Work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of Work.

4. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing System Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty will become null and void on date of said alterations, but only to the extent said alterations affect Work covered by this Warranty. If Owner engages Roofing System Installer to perform said alterations, Warranty will not become null and void unless Roofing System Installer, before starting said Work, will have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty will become null and void on date of said change, but only to the extent said change affects Work covered by this Warranty.
6. Owner will promptly notify Roofing System Installer of observed, known, or suspected leaks, defects, or deterioration and afford reasonable opportunity for Roofing System Installer to inspect Work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing System Installer on said Work and will not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty will not operate to relieve Roofing System Installer of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.
3. Miscellaneous materials.

B. Related Requirements:

1. Section 07 41 01 “Architectural Standing Seam Metal Roof System” for sheet metal flashing and trim integral with metal roofing panels.
2. Section 07 42 13 “Formed Metal Wall Panels” for sheet metal flashing and trim integral with metal wall panels.
3. Section 07 42 13 “Formed Metal Wall Panels” for sheet metal flashing and trim integral with composite metal wall panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1. Plans, elevations, sections, and attachment details.
2. Identification of material, thickness, weight, and finish for each item and location in Project.
3. Details for forming, including profiles, shapes, seams, and dimensions.
4. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
5. Details of connections to adjoining work.
6. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For fabricator.

B. Sample warranties.

1.5 QUALITY ASSURANCE

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

B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers.

C. For roof edge flashings and copings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop is to be listed as able to fabricate required details as tested and approved.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.7 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.8 WARRANTY

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

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: Based on current code and project location.

D. FM Approvals Listing: Manufacture and install roof edge flashings and copings that comply with requirements in FM Approvals 4471 as part of a roofing system and that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, Class 1A-90 minimum. Identify materials with name of fabricator and design approved by FM Approvals.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with minimum ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with minimum ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.

C. Nominal Thickness: 0.028 inch, minimum.

1. Thickness: As required to wind uplift pressures.
2. Surface: Smooth, flat.
3. Exposed Coil-Coated Finish:

    a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

4. Color: As selected by Architect from manufacturer's full range.
5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.

B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum, of type required for application.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Zinc-Coated (Galvanized) or Aluminum-Zinc Alloy-Coated Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

G. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. 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.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.

5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, non-expansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 12 ft. long sections. Furnish with 6-inch- wide, joint cover plates. Shop fabricate interior and exterior corners.

1. Joint Style: Overlapped, 4 inches wide.
2. Fabricate with scuppers spaced 10 ft. apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate from the following materials:

a. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

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

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.7 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

E. Apron and Backer Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

F. Drip Edges: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

G. Eave, Rake, and Ridge Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

H. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

I. Flashing Receivers: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

J. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

B. Wall Expansion-Joint Cover: Fabricate from the following materials:

1. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

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

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

1. Install in shingle fashion to shed water.
2. Lapp joints not less than 4 inches.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
7. Do not field cut sheet metal flashing and trim by torch.
8. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

    a. Embed hooked flanges of joint members not less than 1 inch into sealant.
    b. Form joints to completely conceal sealant.
    c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.

d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL SHEET METAL FABRICATIONS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise 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, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

A. Clean off excess sealants.

3.8 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 72 33 – ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal roof hatches with integral curbs
2. Curb-mount, collapsible / folding safety rail systems

1.2 REFERENCES

A. OSHA 29 CFR 1910.28 / 1910.29: Walking-working surfaces and fall protection guardrail

B. ASTM A500 / A500M: Cold formed welded and seamless carbon steel structural tubing.

C. ASTM B221: Aluminum alloy, extruded bars, rods, and shapes

1.3 SUBMITTALS

A. Product Data: manufacturer’s standard details, mounting details, installation instructions for hatch and rail assemblies.

B. Shop Drawings: indicate dimensions, weight, structural framing connections and method of attachment to the roof curb.

C. Regulatory Compliance: Documentation showing guardrail meets OSHA 200-lb. top-rail force requirements.

PART 2 - PRODUCTS

2.1 ROOF HATCH

A. Type: Single leaf, curb mounted, metal roof access hatch.

B. Size: As indicated in the drawings.

C. Curb: 11-gage aluminum or 14-gage galvanneal steel, minimum 12-inches high, with integral cap flashing, continuous positive anchor / mounting flange, and fully insulated, minimum R-6.

D. Cover: Insulated single-leaf cover, reinforced for 50psf live load / wind uplift, with continuous EPDM rubber weather seal gasketing.

E. Operation: Counterbalanced compression springs enclosed in zinc-plated steel cylinders to ensure smooth operation. Automatic hold-open arm with release handle.

F. Hardware: Type 316 stainless steel hinges, slam latch with interior / exterior handles, and padlock hasps.

2.2 CURB MOUNTED COLLAPSIBLE GUARDRAIL SYSTEM

A. Modular guardrail perimeter framework engineered to mount directly onto the exterior of the roof hatch curb (zero roof membrane penetration).

B. Collapsible Action: Mechanical folding or collapsible design that automatically pivots / lowers or folds flat when the hatch cover closes, retracting to a low-profile above the roof surface.

C. Materials: 1-1/4-inch schedule 40 6061-T6 aluminum pipe or high strength steel tubing.

D. Height: 42-inches above the finished roof level when in the upright and locked position.

E. Gate: Factory-integrated, self-closing safety gate with stainless steel gravity hinges and latch. Chains or open bars are prohibited.

F. Fasteners: Type 316 stainless steel or zinc-plated structural hardware matching curb mounting brackets.

G. Finish: Safety yellow, powder coat finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that structural roof opening and roof curbs are correctly sized, level, and ready for installation.

B. Verify that roofing membrane and base flashings are complete up to the base of the hatch curb.

3.2 INSTALLATION

A. Install roof hatch securely to roof curb in accordance with manufacturer’s written instructions.

B. Mount collapsible guardrail assembly directly to the exterior of the hatch curb using non-penetrating clamping brackets.

C. Adjust collapsible mechanism, latches, and self-closing gate to ensure smooth opening, positive latching, and unobstructed functional clearance.

3.3 ADJUSTING AND CLEANING

A. Test operating mechanism of both hatch cover and folding rail system through multiple cycles.

B. Clean exposed metal surfaces, repair any minor finish abrasions using touch-up coating compatible with original factory finish.

END OF SECTION 07 72 33

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Butyl joint sealants.
5. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data for all sealants scheduled for use.

B. Samples for Initial Selection: Manufacturer's standard color charts **consisting of strips of cured sealants** showing the full range of colors available for each product exposed to view, including metallic colors (if available).

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.

1.3 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.4 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.

1.5 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation
c. Sika Corporation - Building Components
d. The Dow Chemical Company]
e. Tremco Incorporated
f. Or Prior Approved Equal.

2.4 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bostik; Arkema
b. Pecora Corporation
c. Sika Corporation - Building Components
d. Tremco Incorporated
e. Or Prior Approved Equal.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation
c. Sika Corporation - Building Components
d. The Dow Chemical Company
e. Tremco Incorporated
f. Or Prior Approved Equal

2.6 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bostik; Arkema
b. Pecora Corporation
c. Sika Corporation - Building Components
d. Or Prior Approved Equal.

2.7 LATEX JOINT SEALANTS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Pecora Corporation
b. PPG Paints; PPG Industries, Inc.
c. Sherwin-Williams Company (The)
d. Tremco Incorporated
e. Or Prior Approved Equal.

2.8 JOINT-SEALANT BACKING

A. Sealant Backing Material: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

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

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

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 CLEANING

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

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 PROTECTION

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints in unit masonry.
    b. Joints between metal panels.
    c. Joints between different materials listed above.
    d. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    e. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry walls.
    d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:

    a. Aluminum thresholds.
    b. Sill plates.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Product Data Submittals: For each product.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; AADG, Inc.; ASSA ABLOY
2. Curries, AADG, Inc.; ASSA ABLOY Group
3. Custom Metal Products
4. Republic Doors and Frames; a Allegion brand
5. Steelcraft; Allegion plc

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch.
b. Construction: Full profile welded.

2. Exposed Finish: Prime.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule on Drawings.
   b. Thickness: 1-3/4-inches.
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   d. Edge Construction: Model 1, Full Flush.
   e. Edge Bevel: Bevel lock and hinge edges 1/8-inch in 2-inches.
   f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
   g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
   h. Core: Qmax thermal insulation.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
   b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24-inches of frame height above 7-feet.
3. Post installed Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

2.6 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4-inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement,

mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive non-templated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

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

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

    a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with post installed expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of post installed expansion anchors if so indicated and approved on Shop Drawings.

3. Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
5. In-Place Concrete or Masonry Construction: Secure frames in place with post installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16-inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Smoke-Control Doors: Install doors in accordance with NFPA 105.

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.

B. Product Data Submittals: For each product, including the following:

1. Door core materials and construction.
2. Factory-finishing specifications.

C. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.

D. Samples for Verification: Factory finishes applied to actual door face materials, approximately 8-inches by 10-inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.

1.3 CLOSEOUT SUBMITTALS

A. Special warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60- and 90-deg F and relative humidity between 43- and 70-percent during remainder of construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4-inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01-inch in a 3-inch span.

2. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

B. Composite Wood Products: Products shall be made without urea formaldehyde.

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

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following – **Basis of Design, VT Industries**:

    a. Masonite Architectural
    b. Oshkosh Door Company
    c. Or Prior Approved Equal

2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
3. Architectural Woodwork Standards Quality Grade: Custom.
4. Faces: Single-ply, wood veneer not less than 1/50-inch thick.

    a. Species: White Oak
    b. Cut: Rift Cut
    c. Match between Veneer Leaves: Slip match.
    d. Assembly of Veneer Leaves on Door Faces: Center-balance match.

        1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20-feet or more.

    e. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

        1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

5. Core for Non-Fire-Rated Doors:

    a. Either glued wood stave or WDMA I.S. 10 structural composite lumber.

        1) Screw Withdrawal, Door Face: 550 lbf.
        2) Screw Withdrawal, Vertical Door Edge: 550 lbf.

6. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Species compatible with door faces.
2. Profile: Flush rectangular beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Custom. TR-6 Catalyzed Polyurethane.
2. Sheen: Satin.
3. Color: As indicated in Finish Legend in Drawings; if not indicated, as selected from manufacturer’s full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size,

location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Condition doors to average prevailing humidity in installation area prior to hanging.

C. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

D. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails[or finishing screws] for exposed fastening, countersunk and filled flush with woodwork.

        1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors and frames in accordance with NFPA 80.
4. Install smoke- and draft-control doors in accordance with NFPA 105.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sectional-door assemblies.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
2. Section 06 10 00 “Rough Carpentry” for wood blocking.
3. Section 07 90 00 “Joint Sealants” for perimeter sealant and backup materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.

B. Shop Drawings: For each installation and for components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. Include hardware locations.

C. Samples: For each type of exposed finish and for each color and texture required on the following components, in manufacturer's standard sizes:

1. Glazing.
2. Exposed finish.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For manufacturer's warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

D. Hardware Extended Warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Failure of components or operators before reaching required number of operation cycles.
c. Faulty operation of hardware.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
e. Delamination of exterior or interior facing materials.

2. Warranty Period: One year from date of Substantial Completion.

B. Finish Warranty: 5 Years.

C. Extended Warranty: Extended 8-year warranty on hardware.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sectional doors from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication,

installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.

1. Design Wind Load: As indicated on Structural Drawings.
2. Testing: In accordance with ASTM E330/E330M.
3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.

    a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
    b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

4. Operability under Wind Load: Design sectional doors to remain operable under uniform pressure (velocity pressure) of 20 lbf/sq. ft. wind load, acting inward and outward.

2.3 SECTIONAL-DOOR ASSEMBLY

A. Sectional Door: Provide aluminum sectional door formed with hinged sections and fabricated so that finished door assembly is rigid and aligned with tight hairline joints; free of warp, twist, and deformation; and complies with requirements in DASMA 102.

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Clopay; Model 904** or comparable product by one of the following:

    a. Amarr Company
    b. Cookson; a CornellCookson company
    c. Cornell; a CornellCookson company
    d. McKeon Door Company
    e. Raynor Garage Doors
    f. Wayne Dalton; a division of Overhead Door Corporation

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. when tested in accordance with ASTM E283 or DASMA 105.

D. Aluminum Sections: ASTM B221 extruded-aluminum stile and rail members of alloy and temper standard with manufacturer for type of use and finish indicated; in minimum thickness required to comply with requirements; with rail and stile dimensions and profiles indicated on Drawings; and with overlapped or interlocked weather- and pinch-resistant seal at meeting rails.

1. Door-Section Thickness: 2-1/8-inches.
2. Section Reinforcing: Continuous horizontal and diagonal reinforcement as

required to stiffen door and for wind loading. Ensure that reinforcement does not obstruct vision lites.

a. Hardware Locations: Provide reinforcement for hardware attachment.

3. Insulated Stiles and Rails: Fill stiles and rails manufacturer's standard polyurethane expanding foam.
4. Glazed Panels: Manufacturer's standard, aluminum-framed section with glazing sealed with glazing tape and aluminum glazing bead. Glazing as follows:

a. Insulating Glass Units: 1/2-inch Low E Insulation glass with tempered glass lites complying with ASTM C1048, Kind FT (fully tempered), Condition A (uncoated), Type I, Class 1 (clear), Quality-Q3.

E. Track: Manufacturer's standard, galvanized-steel, standard-lift or low-headroom track system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

1. Material: Galvanized steel, ASTM A653/A653M, minimum G60 zinc coating.
2. Size: As recommended in writing by manufacturer for door size, weight, track configuration and door clearances indicated on Drawings.
3. Track Reinforcement and Supports: Provide galvanized-steel members to support track without sag, sway, and vibration during opening and closing of doors. Slot vertical sections of track spaced 2 inches apart for door-drop safety device.

a. Vertical Track: Incline vertical track to ensure weathertight closure at jambs. Provide continuous angle or continuous reverse angle attached to track and wall.
b. Horizontal Track: Provide continuous reinforcing angle from curve in track to end of track, attached to track and supported at points by laterally braced attachments to overhead structural members.

F. Weatherseals: Replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom top and jambs of door.

G. Hardware: Heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless steel, or other corrosion-resistant fasteners, to suit door type.

1. Hinges: Heavy-duty, galvanized-steel hinges of not less than 0.079-inch nominal coated thickness at each end stile and at each intermediate stile, in accordance with manufacturer's written recommendations for door size.

a. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is impossible.
b. Provide double-end hinges where required for doors more than 16 ft. wide unless otherwise recommended by door manufacturer in writing.

2. Rollers: Heavy-duty rollers with steel ball bearings in case-hardened steel races, mounted to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Match roller-tire diameter to track width.

    a. Roller-Tire Material: Manufacturer's standard.

3. Push/Pull Handles: Equip each door with galvanized-steel lifting handles on each side of door, finished to match door.

H. Locking Device:

1. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.
2. Chain Lock Keeper: Suitable for padlock.

I. Counterbalance Mechanism:

1. Torsion Spring: Adjustable-tension torsion springs complying with requirements of DASMA 102 for number of operation cycles indicated, mounted on torsion shaft.
2. Cable Drums and Shaft for Doors: Cast-aluminum cable drums mounted on torsion shaft and grooved to receive door-lifting cables as door is raised.

    a. Mount counterbalance mechanism with manufacturer's standard ball-bearing brackets at each end of torsion shaft.
    b. Provide one additional midpoint bracket for shafts up to 16 ft. long and two additional brackets at one-third points to support shafts more than 16 ft. long unless closer spacing is recommended in writing by door manufacturer.

3. Cables: Galvanized-steel, multistrand, lifting cables with cable safety factor of at least 7 to 1.
4. Cable Safety Device: Include a spring-loaded steel or bronze cam mounted to bottom door roller assembly on each side and designed to automatically stop door if lifting cable breaks.
5. Bracket: Provide anchor support bracket as required to connect stationary end of spring to the wall and to level the shaft and prevent sag.
6. Bumper: Provide spring bumper at each horizontal track to cushion door at end of opening operation.

J. Manual Door Operator:

1. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25 lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

K. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

1. Anodized Aluminum Finish: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

    a. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

B. Tracks:

1. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
2. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

END OF SECTION 08 36 13

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems for exterior openings.
2. Manual swing doors, including hardware.

B. Related Sections include the following:

1. DIV 08 Section “Flush Wood Doors”
2. DIV 08 Section “Door Hardware”
3. DIV 08 Section “Glass and Glazing”

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. For aluminum windows, include details for mounting and securing to aluminum framing.

B. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
4. Signed and sealed by the qualified professional engineer responsible for their preparation.

C. Entrance Door Hardware Schedule: Prepared by, or under supervision of, supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, access control, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.

E. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Maintenance Data: For operating hardware to include in maintenance manuals.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For aluminum-framed entrance and storefront systems, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample Warranties: For aluminum-framed entrance and storefront systems.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.6 QUALITY ASSURANCE

A. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

A. Special Warranty: Manufacturer agree to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

B. Structural Loads:

1. Wind Loads: As indicated on Drawings.

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of length of span of the framing member for lengths of up to 13-feet 6-inches and to 1/240 of length of span of the framing member plus 1/4-inch for lengths greater than 13-feet 6-inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8-inch.

D. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:

1. Fixed Framing and Glass Area: Provide glazed aluminum entrance system with permanent resistance to air leakage through system of not more than 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E283 at static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq. ft..

G. Water Penetration under Dynamic Pressure: Test according to AAMA 501.1 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20-percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.
2. Maximum Water Leakage: According to AAMA 501.1: No uncontrolled water penetrating assemblies or water appearing on assemblies' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters, or water that is drained to the exterior.

H. Condensation Resistance: Provide glazed aluminum entrance system with condensation resistance factor (CRF) of not less than 55 when tested according to AAMA 1503.1.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

J. Dimensional Tolerances: Provide glazed aluminum entrance system, including Anchorage, that accommodates dimensional tolerances of building frame and other adjacent construction.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kawneer Company, Inc.; Arconic Corporation
2. OldCastle BuildingEnvelope (OBE)
3. Trulite Glass & Aluminum Solutions, LLC.
4. U.S. Aluminum; C.R. Laurence Co., Inc.; CRH Americas, Inc.
5. YKK AP America Inc.
6. Or Prior Approve Equals

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.

a. Basis of Design Product is **Kawneer Trifab® VersaGlaze® 451T**

3. Interior Framing Construction: Nonthermal.

a. Basis of Design Product is **Kawneer Trifab® VersaGlaze® 450**

4. Glazing System:

a. Retained mechanically with gaskets on four sides

5. Glazing Plane: Front.
6. Finish: Color Anodic finish.
7. Fabrication Method: Field-fabricated stick system.
8. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
9. Steel Reinforcement: As required by manufacturer.

A. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

    a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
    b. Basis-of-Design product is Kawneer 500 T Insulpour® Thermal Entrances.

2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

    a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.2 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. General: Provide door hardware, and hardware sets indicated in Division 8 Section, Door Hardware, for each entrance door to comply with requirements in this Section.

1. Sequence of Operation: Where indicated, provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
2. Opening Force Requirements:

    a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30lbf to set the door in motion, and not more than 15 lbf to open the door to its minimum required width.
    b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

C. Continuous Gear Hinges: Manufacturer’s standard with stainless-steel bearings between knuckles, fabricated to full height of door and frame,

D. Pull Handles: Bent tube design. Basis of Design Selection: CO-9 pulls by Kawneer, or approved equivalent products by listed manufacturers.

E. Deadlatch Assembly: Complete with latchbolt, cylinder cam, case, and trim plates. Push paddle inside, keyed outside.

1. Comply with keying and keycode requirements specified herein.

F. Products – Basis of Design: 4510 Deadlatch by Adams-Rite ASSA ABLOY or approved equivalent products by listed manufacturers.

1. Keying and Key Cores: Master key system with interchangeable key cores.

Refer to DIV 8 Section, Door Hardware.

G. Rim-Mounted Panic Exit Devices: BHMA A 156.3, Grade 1, listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protections, based on testing according to UL 305. Rim-type exit device with one-point latching at door-lock stile or removable mullion, that is release by a full-width crash bar or when locked down (dogged) by lock cylinder or retracting screws beneath housing.

1. Keying and Key Cores: Master key system with interchangeable key cores. Refer to DIV 8 Section, Door Hardware.

H. Strikes: Provide strike with black plastic dust box for each latch or lock bolt; fabricated for aluminum framing.

I. Electric Strikes: Refer to DIV 8 Section Door Hardware.

J. Operating Trim: BHMA A 156.6.

K. Removable Mullions: BHMA A 156.3, extruded aluminum of same finish as doors and frames. Set screw removable.

L. Closers: BHMA A 156.4, Grade 1, with accessories required for complete installation, sized as required by door size, exposure to weather, and anticipated frequency of use; adjustable to comply with field conditions and requirements for opening force.

M. Door Stops: BHMA A 156.16, Grade 1, floor or wall mounted, as appropriate for door location indicated, with integral rubber bumper.

N. Weather Stripping: Manufacturer’s standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701 / 702, made of wool, polypropylene, nylon woven pile with nylon-fabric or aluminum strip backing.

O. Weather Sweeps: Manufacturer’s standard exterior-door adjustable bottom brush sweep with concealed fasteners on mounting strip.

P. Thresholds: BHMA A 156.21, raised thresholds beveled with a slope of not more than 1:2, with a maximum height of 1/2-inch.

2.3 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by

structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

2.4 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.5 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless-steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC filler.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Storefront Framing: Fabricate components for assembly using shear-block system.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.8 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Sill Flashings: Provide fabricated one-piece continuous sill flashings under exterior sill frame members.

1. Provide one-piece formed metal sill flashing full width of opening.
2. Where openings are far in excess of 10-feet, lap sill flashings at 6-inches with full bed sealant.

I. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

J. Install joint filler behind sealant as recommended by sealant manufacturer.

K. Install components plumb and true in alignment with established lines and grades.

L. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather

stripping.

2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

M. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:

1. Plumb: 1/8-inch in 10 feet; 1/4-inch in 40-feet.
2. Level: 1/8-inch in 20 feet; 1/4-inch in 40-feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2-inch wide, limit offset from true alignment to 1/16-inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2- to 1-inch wide, limit offset from true alignment to 1/8-inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4-inch.

4. Location: Limit variation from plane to 1/8-inch in 12-feet; 1/2-inch over total length.

END OF SECTION 08 41 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

1.2 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Contractor will be required to retain Owner’s subcontractor for the installation of access control rough-ins and devices, and coordinate door hardware and keying with Owner's security consultant. **AAMSCO 9811 Interstate 30, Suite 3, Little Rock, AR 72209; (501) 562-3737. Contact: Sherri Davis.**

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

D. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field-verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant and Owner’s security consultant, **AAMSCO.**

B. Keying Conference: Conduct conference at Project site.

1. Conference participants must include Installer's Architectural Hardware Consultant.
2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system, including, but not limited to, the following:

    a. Flow of traffic and degree of security required.
    b. Preliminary key system schematic diagram.
    c. Requirements for key control system.
    d. Requirements for access control.
    e. Address for delivery of keys.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.
3. Point to point wiring.
4. Risers
5. Elevations of doors controlled by electrified door hardware.
6. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For each type of exposed finish.

D. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of product data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:

    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on

floor plans and to door and frame schedule.

c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.

e. Fastenings and other installation information.

f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.

g. Mounting locations for door hardware.

h. List of related door devices specified in other Sections for each door and frame.

E. Keying Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of electrified door hardware.

B. Product Test Reports: For compliance with accessibility requirements, for tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals.

B. Schedules: Final door hardware, **keying schedule**, and **bitting schedule**.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lockup for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner by registered mail or overnight package service.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including excessive deflection, cracking, or breakage.
b. Faulty operation of doors and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:

a. Exit Devices: Two years from date of Substantial Completion.
b. Manual Closers: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

C. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the USDOJ's "2010 ADA Standards for Accessible Design".

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities

having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.
5. Adjust spring hinges so that, from an open position of 70 degrees, the door will take at least 1.5 seconds to move to the closed position.

2.3 HINGES

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

1. Quantity: Provide the following hinge quantity:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weigh and Base Material: Unless otherwise indicated, provide the following:

   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight. t:

4. Hinge Options: Comply with the following:

   a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bommer Industries, Inc
b. Hager Companies
c. McKinney Products Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY

2.2 CONTINUOUS HINGES

A. Continuous, Gear-Type Hinges: ANSI/BHMA A156.26; minimum 0.120-inch- thick, extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings. Minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bommer Industries, Inc
b. Hager Companies
c. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Hagar Companies (HA) – ETW-QC (# wires) Option.
b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC (# wires) Option.
c. Stanley Hardware (ST) – C Option.
d. Ives
e. PBB

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Electrified transfer continuous geared hinges with a removable service panel cutout accessible without demounting door from frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) –

SER-QC (# wires) Option.
b. Hagar Companies (HA)
c. Stanley Hardware (ST)
d. PBB

C. Electric Door Wire Harness: Electric / data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connectors are not acceptable. Determine the length required for each electrified hardware component of the door type, size, and construction, minimum of two per electrified opening.

1. Provide one of each type of the following tools as part of the base bid contract:

   a. McKinney Products (MK) Electrical Connecting Kit: QC-R001
   b. McKinney Products (MK) Connector Hand Tool: QC-R003

2. Manufacturers:

   a. Hagar Companies (HA) – Quick Connect
   b. McKinney Products (MK) – QC-C Series
   c. Stanley Hardware (ST) – WH Series

2.4 LOCKSETS

A. Mortise Locksets: ANSI / BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets manufactured with a corrosion resistant steel case. Heavy-duty mortise lockset with rectangular escutcheon plate trim. Plastic parts are not permitted.

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.
3. Field reversible without disassembling lock body.
4. Where specified, provide status indicators with highly reflective color and working for “locked / unlocked” or “vacant / occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1-inches by 0.6-inches with a curved design allowing a 180-degree viewing angle with protective covering to prevent tampering.
5. Strikes: Manufacturer’s standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set.

   a. Strikes for Mortise Locks and Latches: BHMA A156.13.
   b. Flat Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by the manufacturer.
   c. Aluminum Frame Strike Box: Manufacturer’s special strike box fabricated for aluminum framing.

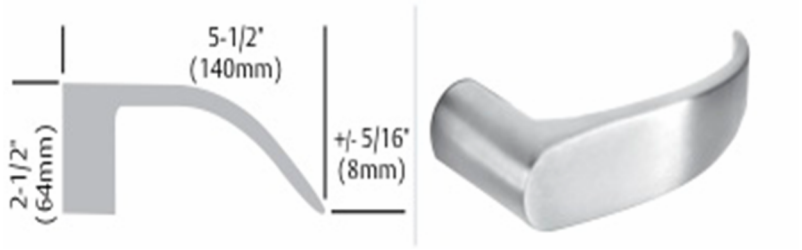
d. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

B. Lock Functions: As indicated in door hardware schedule.

C. Lock Backset: 2-3/4-inches unless otherwise indicated.

D. Lock Trim:

1. Levers: Cast.
2. Lever Design: Arc lever design handles with elongated escutcheon trim plate.



3. Escutcheons (Roses): Cast.
4. Fronts for Mortise Locks and Latches: Standard bevel, armored fronts.
5. Products: one of the following:

   a. Basis of Design: **Pacific Beach PB, 8800 / 8822 Series by Yale**.
   b. P-Lever, 8200 by Sargent.
   c. L17, L9000 Series by Schlage.

6. Mortise Locks: Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Corbin Russwin, Inc.; ASSA ABLOY – ML2000CLS3300 Series
   b. Sargent Manufacturing Company; ASSA ABLOY - 8200 Series
   c. Schlage; Allegion – L Series
   d. Yale; ASSA ABLOY - 8800 Series

2.5 EXIT DEVICES

A. Rim Panic Exit Devices: BHMA A156.13, Grade 1, Surface mount, Type 1, Figure 3, marrow stile push pad, function 05.

1. Heavy-duty rating.
2. UL Listed as panic hardware at non-rated doors. Complying with NFPA 101 and listed and labeled for “Panic Hardware” according to UL 305.
3. Through-bolt mounting to doors with fasteners as required by frame material.
4. Outside Teim: Lever design to match lockset lever as described above with rectangular escutcheon plates.
5. Exit devices with hex key dogging device to hold the pushbar and latch in a retracted position.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer’s heavy-duty escutcheon trim with threaded studs for through-bolts.

a. For access from exterior, provide operating hardware key access; comply with key cores and keying as described in this section.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings. Provie a less bottom rod (LBR) unless noted otherwise. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Dummy pushbar: non-functioning push bar matching functional pushbar.
9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
10. Through-bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI / BHMA A156.13, Grade 1 Certified Products Directory (CPD) listed panic exit hardware devices; functions as specified in the Hardware Sets.

1. Exit device latch to be stainless steel, pullman type, with deadlock feature.

C. Manufacturers: One of the following:

1. Yale 7155 Series
2. Sargent GL-80 Series
3. VonDuprin 98 XL Series

2.6 REMOVABLE MULLIONS

A. Steel construction with set screw removable, keyed not acceptable; designed to receive doors and rim panic devices indicated. Include mounting brackets and mullion stabilizers.

1. Products: Provide one of the following:

a. Yale M200
b. Sargent L980S
c. VonDuprin 4954

2.7 ELECTROMECHANICAL EXIT DEVICES

A. Electromechanical Push Rail Exit Devices (Heavy Duty): ANSI / BHMA A156.3, Grade 1, Certified Products Directory (CPD) listed panic exit hardware devices subject to same compliance standards and requirements as mechanical exit devices.

1. Energy Efficient Design: Devices which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
2. Where conventional power supplies are not sufficient, include specific controllers require to provide the proper inrush current.
3. Motorized Electric Latch Retraction: Devices with an electric latch retraction

feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

2.8 ELECTRIC STRIKES WITH RELEASE DEVICES

A. Electric Strikes: BHMA A156.32; Grade 1; Surface mounted rim exit device electric strikes and UL listed for both burglary resistance and for use on fire rated door assemblies.

1. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles.
2. Strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified.
3. Latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
4. Strike requires no cutting of the jamb prior to installation, with faceplate to suite lock and frame.
5. Coordination: 120V electrical service is provided by electrical work above / near doors. Electric device hardware manufacturer shall include transformers, conductors, and all related accessories for operation of this system.

B. Proximity Readers: Match Owner's existing system.

C. Push-Button Release: Manufacturer's surface mounted pushbutton release for electric strike.

1. Location: Coordinate with Owner and Architect for final location.
2. Operation: Connect with low voltage connectors, route to device.

D. Manufacturers: Subject to compliance with project requirements, provide products by the following or approved equal:

1. Adams Rite Manufacturing Co, (ARM)
2. Folger Adam Security Inc.; ASSA ABLOY Group Company (FAS)
3. HES, Inc.; ASSA ABLOY Group Company (HES)
4. Locknetics, Ingersol Rand Company (LSE)
5. Security Door Controls (SDC)
6. VonDuprin, Ingersol Rand Company (VD)

2.9 LOCK CYLINDERS

A. General: Cylinder manufacturer to have minimum (10) years' experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Patented Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents.

1. Patented key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.
2. Manufacturer: To match existing campus system.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.10 KEYING

A. Keying System: Factory registered, complying with guidelines in ANSI/BHMA A156.28, appendix. Provide one extra key blank for each lock. Incorporate decisions made in keying conference.

1. Existing System:

a. Master key or grand master key locks to Owner's existing system.

2. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: Information to be furnished by Owner.

2.11 PUSH PULLS

A. ANSI A156.6. Manufacturer's standard exposed fasteners for installation. Through-bolted for matched pairs, but not for single units.

1. Plates: 0.050-inch thick with 6-inch by 16-inch stainless steel plates.
2. Products: 8200 pull and 8306-2 pull plate by Ives; 1001-9 and 1001-9 3B pull by Trimco, or approved equal.

2.12 SURFACE CLOSERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Corbin Russwin, Inc.; ASSA ABLOY – CD6000 Series
    b. LCN; Allegion plc – 4040 Series
    c. SARGENT Manufacturing Company; ASSA ABLOY – 281 Series

2.13 MECHANICAL STOPS AND HOLDERS

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

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Burns Manufacturing Incorporated
    b. Rockwood Manufacturing Company; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY
    c. Trimco

2.14 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: ANSI/BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Glynn-Johnson; Allegion plc – 81 Series
    b. Rixson Specialty Door Controls; ASSA ABLOY – 9 Series
    c. SARGENT Manufacturing Company; ASSA ABLOY – 1500 Series

2.15 KICK PLATES AND PROTECTION PLATES

A. General: ANSI A156.6 stainless steel, 18 gage thick material unless indicated otherwise, protection plates. Width no more than 1-1/2-inch on stop side smaller than the door width x height indicated.

B. Kickplates: J102, 10-inches high.

C. Door Protection Plates: 30-inches high.

2.16 DOOR GASKETING

A. Door Gasketing: ANSI/BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. National Guard Products, Inc
b. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY
c. Reese Enterprises, Inc

B. Maximum Air Leakage: When tested in accordance with ASTM E283/E283M with tested pressure differential of 0.3 inch wg, as follows:

1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per ft. of door opening.

2.17 MISCELLANEOUS DEVICES

A. Mutes / Silencers: ANSI A156.16; L03011. Rubber type, 3 for single door openings and 4 for double door openings; color: grey.

1. Products: GJ64 by Glynn Johnson, 1229A by Trimco, 608 by Rockwood, or approved equal.

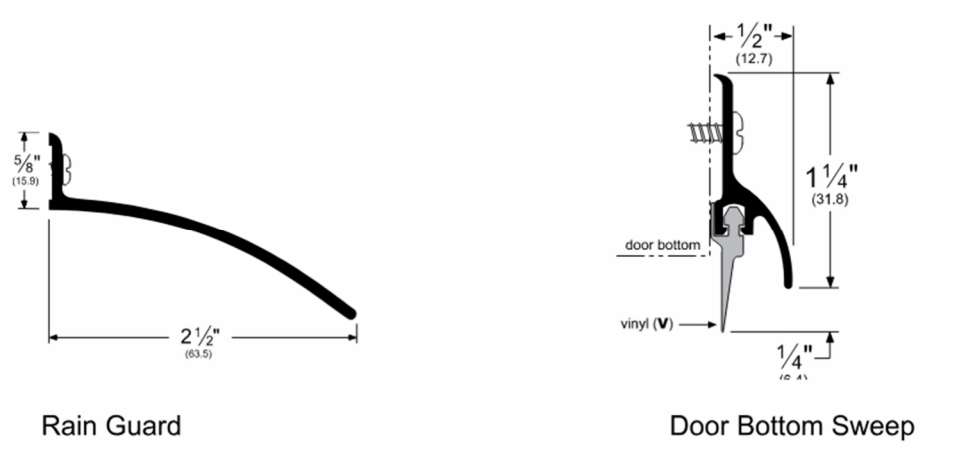
B. Astragals: Overlapping type, continuous metal with continuous elastomeric strip material such as silicone or neoprene.

1. Products: 158SA by National Guard Products: 355CS by Pemko, or approved equal.

C. Lock Protectors: 18 gage stainless steel.

1. LP3 by Glynn Johnson, or approved equal.

D. Rain Guard: Overhead aluminum rain diverter. Surface mount to head of frame of door. Pemko 346-C or approved equal.



Rain Guard Door Bottom Sweep

E. Door Bottom Sweep: Continuous aluminum retainer drip, with replaceable vinyl sweep. Surface mount to the bottom of the door. 3452-C Pemko, or approved equal.

2.18 WEATHERSTIPPING AND SEALS

A. Description: Continuous bulb seal made of vinyl, neoprene, polypropylene, or silicone with aluminum retainer fastened to door frame at head and jamb sides. UL rated. Non-corrosive fasteners for exterior door applications and elsewhere as indicated.

B. Replaceable Seal Strips: Provide units where resilient or flexible seal strip is easily replaceable and readily available from stocks maintained by the manufacturer.

C. Products: Model 807 by Reese, 160 by National Guard, 303 by Pemko, or approved equal.

2.19 THRESHOLDS

A. Thresholds: ANSI/BHMA A156.21; fabricated to full width of opening indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. National Guard Products, Inc
   b. Pemko Manufacturing Company Inc.; ASSA ABLOY Accessories and Door Controls Group, Inc.; ASSA ABLOY
   c. Reese Enterprises, Inc

B. Saddle Thresholds: ANSI A156.21, extruded aluminum with corrugated top, profile designed for handicap accessibility.

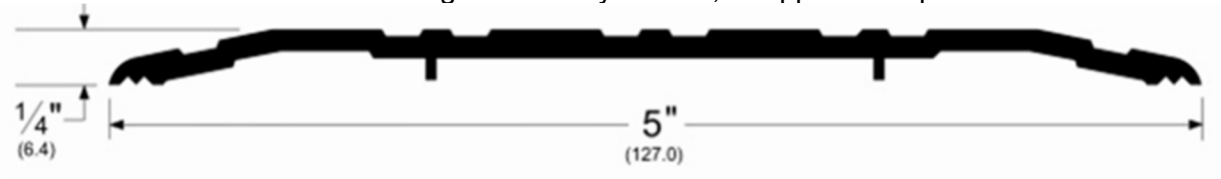
1. Types of Saddle Thresholds: Provide the following types for locations with types of flooring as indicated below. Type selected by Contractor in coordination with flooring types.

   a. Basis of Design Products by Pemko as indicated below, or products by

Hager, National Guard, Reese, Zero, or approved equal.

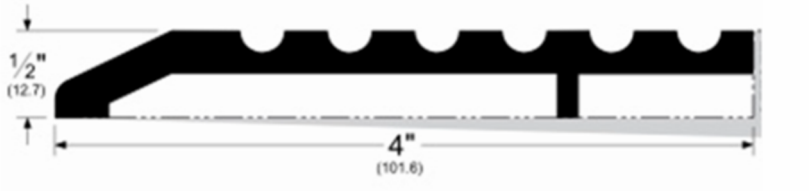
2. Type for openings with resilient tile or other flush floor transitioning to exposed concrete.

    a. 1/4-inch high by 5-inch width.
    b. Basis of Design: 1665A by Pemko, or approved equal.



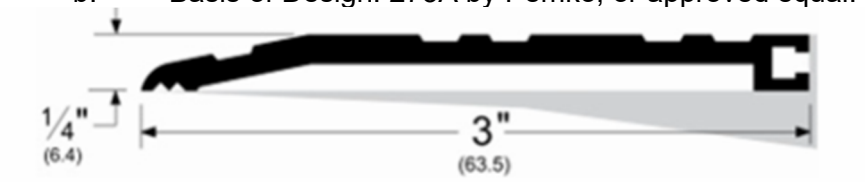
3. Type for openings with resilient flooring and ceramic tile.

    a. 1/2-inch high by 4-inch width.
    b. Basis of Design: 227A by Pemko, or approved equal.



4. Type for openings with resilient floor and carpet.

    a. 1/4-inch high x 3-inch width.
    b. Basis of Design: 273A by Pemko, or approved equal.



2.20 FABRICATION

A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and ANSI/BHMA A156.18.

B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended; however, aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

    1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use

through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.21 FINISHES

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

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

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Designations used to indicate hardware finishes are listed in ANSI A156.18. Unless otherwise noted, provide the following finishes for items noted:

1. Closers: 628, satin aluminum
2. Hinges and Locksets:
    a. Interior Doors: 626, satin chrome
    b. Exterior Doors: 630, satin stainless steel
3. Door Stop: 630, satin stainless steel
4. Kickplate: 630, satin stainless steel
5. Push / Pulls: 630, satin stainless steel
6. Astragals: 626, satin chrome
7. Others: 626, 630, or 628 for base metal of hardware furnished.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames in accordance with ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION OF DOOR HARDWARE

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

G. Closers: Provide through-bolts to fasten portion of closer at door leaf. Include reinforcing plate.

H. Weatherstripping and Seals: Comply with manufacturer’s instructions and

recommendations to the extent installation requirements are not otherwise indicated.

I. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

J. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

1. Do not notch perimeter gasketing to install other surface-applied hardware.

K. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

L. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

M. Electrical Devices: Set up and test for proper operation after installation.

1. Demonstration and Training: Schedule demonstration and training with Owner and Owner's representative.

3.4 ADJUSTING

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

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
2. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 70 degrees and so that closing time complies with accessibility requirements of authorities having jurisdiction.
3. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

B. Occupancy Adjustment: Approximately 3 months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors and door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 MAINTENANCE SERVICE

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

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. General: Develop, submit, and provide hardware sets for each type of door use indicated in the door schedule in the drawings for categories listed below.

1. Where hardware sets are not designated, provide hardware set similar to door serving similar function in the building.
2. Include hardware items where not indicated in hardware sets, but are obviously required for door assembly to work properly as intended.
3. Provide UL labeled seal strips and adjustable door bottom sweeps to all interior doors located at corridors and smoke partitions.
4. Provide hardware of appropriate base metal and rating, and provide UL-rated closers to doors located at fire rated partitions.

3.9 HARDWARE SCHEDULE

A. Hardware Set No. EX-01: Doors 100-01, 100-02

1. Pair, exterior aluminum entrance doors, **access control**
2. Entrance / Egress Doors
   - 2 each ..... continuous hinges
   - 2 each ..... CVR panic device with electrified latch retraction
   - 1 each ..... cylinder
   - 1 each ..... power transfer / wiring harness
   - 1 each ..... card reader
   - 2 each ..... pulls
   - 2 each ..... closers
   - 1 each ..... threshold
   - 1 each .....weatherstripping
   - 2 each ..... overhead arm stops

B. Hardware Set No. EX-02: Doors 101-01, 112-02, 113-03

1. Single, exterior aluminum doors
2. Multipurpose Rooms, Gym
   - 1 each ..... continuous hinge
   - 1 each ..... closer
   - 1 each ..... cylinder, storeroom function
   - 1 each ..... lever trim outside
   - 1 each ..... push paddle inside
   - 1 each ..... weatherstripping
   - 1 each ..... overhead arm stop
   - 1 each ..... threshold

C. Hardware Set No. EX-03: Door 111-01

1. Pair, exterior doors, **access control**
2. Corridor
   - 3 pair ..... hinges
   - 1 each ..... lockset, storeroom function
   - 1 each ..... lever trim
   - 1 each ..... electric strike
   - 1 each ..... wiring harness / power transfer
   - 1 each ..... card reader
   - 2 each ..... closers
   - 1 each .....overlapping astragal on active leaf
   - 1 each ..... top and bottom bolts on inactive leaf
   - 2 each ..... rain guard
   - 1 each ..... weatherstripping
   - 2 each ..... overhead arm stops
   - 2 each ..... kickplates (inside only)
   - 2 each ..... door bottom sweeps
   - 1 each ..... saddle threshold
   - 2 each ..... doorstops (wall stop at door opening to wall)

D. Hardware Set No. EX-04: Door 114-01

1. Single, exterior door
2. Exterior Storeroom
   - 1-1/2- pair ..... hinges
   - 1 each ..... lockset, storeroom function
   - 1 each ..... lever trim outside
   - 1 each ..... push paddle inside
   - 1 each ..... closer
   - 1 each ..... lock protector
   - 1 each ..... rain guard
   - 1 each ..... kickplate
   - 1 each ..... weatherstripping
   - 1 each ..... door bottom sweep
   - 1 each ..... overhead arm stop
   - 1 each ..... threshold

E. Hardware Set No. INT-01: Door 106-01

1. Single, interior door, **access control**
2. E-Sports Classroom
   - 1-1/2 pair ..... hinges
   - 1 each ..... lockset, office function, lever trim
   - 1 each ..... electric strike
   - 1 each ..... card reader
   - 1 each ..... power transfer / wiring harness
   - 1 each ..... closer
   - 1 each ..... doorstop (wall stop for doors opening to wall)
   - 1 each ..... mutes / silencers

F. Hardware Set No. INT-02: Doors 112-01, 113-01

1. Single, interior door
2. Multipurpose Rooms
   - 1-1/2 pair ..... hinges
   - 1 each ..... lockset, office function, lever trim
   - 1 each ..... closer
   - 1 each ..... doorstops (wall stops for doors opening to wall)
   - 1 each ..... mutes / silencers

G. Hardware Set No. INT-03: Doors 102-01, 103-01

1. Single, interior door
2. Public Toilets
   - 1-1/2 pair ..... hinges
   - 1 each closer ..... closer
   - 1 each ..... push / pull
   - 2 each ..... kick plate
   - 1 each ..... doorstops (wall stops for doors opening to wall)
   - 1 each ..... mutes / silencers

H. Hardware Set No. INT-04: Doors 104-01, 110-01

1. Single, interior door
2. Janitor / Electric / IT / Data Closets
   - 1-1/2 pair ..... hinges
   - 1 each ..... lockset, storeroom function, lever trim
   - 1 each ..... closer
   - 1 each ..... kickplate (inside room only)
   - 1 each ..... overhead arm stop
   - 1 each ..... mutes / silencers

I. Hardware Set No. INT-05: Door 105-01

1. Single, interior door
2. E-Sports Storage
   1-1/2 pair ..... hinges
   1 each ..... lockset, office function, lever trim
   1 each ..... doorstops (wall stops for doors opening to wall)
   1 each ..... mutes / silencers

J. Hardware Set No. INT-06: Doors 108-01, 109-01

1. Single, interior door, **access control**
2. Staff Toilets / Bathing
   1-1/2 pair ..... hinges
   1 each..... lockset, privacy function, indicator, lever trim
   1 each ..... power transfer / wiring harness
   1 each ..... electric strike
   1 each ..... card reader
   1 each ..... closer
   1 each ..... kickplate (inside room only)
   1 each ..... doorstops (wall stops for doors opening to wall)
   1 each ..... mutes / silencers

K. Hardware Set No. INT-07: Door 107-01

1. Single, interior door
2. E-Sports Streaming
   1 each ..... continuous hinge
   1 each ..... push / pull
   1 each ..... closer
   1 each ..... mutes / silencers

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Insulating glass.
3. Decorative Film Overlay
4. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 08 14 16 “Flush Wood Doors”
2. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts”

1.2 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12-inches square.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass.

B. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.8 WARRANTY

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

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

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

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

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
3. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

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

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick minimum.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following.

1. Guardian Glass LLC
2. Pilkington North America; NSG Group
3. Vitro Architectural Glass
4. Or Prior Approved Equal.

B. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Aluminum with black, color anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. EPDM or Silicone with Shore A durometer hardness of 85, plus or minus 5.

D. Spacers:

1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks:

1. EPDM or Silicone with Shore A durometer hardness per manufacturer's written instructions.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square

edges with slight chamfers at junctions of edges and faces.

C. Decorative Film Overlay Application: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, with graphic image as indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing

publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Set decorative glass in locations indicated in drawings.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

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

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE – Door Glass Panels and Lites

A. Clear Glass Type (VG-1): Fully tempered float glass.

1. Basis-of-Design Product: Vitro Architectural Glass; Starphire Ultra-Clear.
2. Minimum Thickness: 6 mm.
3. Safety glazing required.

3.7 INSULATING GLASS SCHEDULE – Exterior Storefront

A. Low-E-Coated, Clear Insulating Glass Type (IG-1):

1. Basis-of-Design Product: Vitro Architectural Glass; Solanban® 90 (2) Clear + Clear.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Outdoor Lite: Clear fully tempered float glass.
5. Interspace Content: Air.
6. Indoor Lite: Clear fully tempered float glass.

7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.29 maximum.
9. Visible Light Transmittance: 39 percent minimum.
10. SGHC: 0.21 maximum.
11. Safety glazing required.

END OF SECTION 08 80 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstructural steel framing.
2. Grid suspension systems.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior non-loadbearing, structural framing.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of nonstructural steel framing and fastening and anchorage details.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, and attachments to adjoining work.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For code-compliance certification of studs and track.

B. Evaluation Reports: From an agency acceptable to authorities having jurisdiction showing compliance with Project requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Protect materials from corrosion, deformation, and other damage during delivery, storage, and handling in accordance with AISI S202.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Horizontal Deflection: For composite wall assemblies, limited to 1/360 of the wall height based on the following horizontal loading:

1. Horizontal Loading: 5 lbf/sq. ft.

2.2 NONSTRUCTURAL STEEL FRAMING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AllSteel & Gypsum Products, Inc.
2. ClarkDietrich
3. Consolidated Fabricators Corp.; Building Products Division
4. Mill Steel Framing; Mill Steel Company
5. Steel Construction Systems; Stone Group of Companies
6. Super Stud Building Products Inc.
7. TELLING Industries

B. Framing Members, General: Comply with requirements in AISI S220 for conditions indicated on Drawings.

1. Protective Coating: ASTM A653/A653M, G60 or coating with demonstrated equivalent corrosion resistance. Galvannealed products are unacceptable.

a. Equivalent Corrosion-Resistant Coating: Evaluation report acceptable to authorities having jurisdiction demonstrates corrosion resistance equivalent to specified protective coating.

C. Studs and Track: Conventional members, roll-formed into standard shapes without surface deformations to stiffen framing members.

1. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection, 0.0296 inch minimum. **Full sheet thickness required. “EQ” type designations are not permitted.**
2. Minimum Yield Strength: 33 ksi.
3. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated on Drawings, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to track while allowing 1-1/2-inch-minimum vertical movement.
2. Single Long-Leg Track: Top track with solid, 2-inch-deep flanges in base-steel thickness not less than that of studs, installed with studs friction fit into track and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
3. Slotted Deflection Track: Steel sheet top track manufactured with 2-1/2-inch-deep flanges that allow positive attachment to studs through long slots and prevent deflection of structure above from cracking finishes applied to framing; in base-steel thickness not less than that of studs and in width to accommodate depth of studs.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated on Drawings.

1. Minimum Base-Steel Thickness: 0.0179 inch.

F. U-Channel: Cold-rolled steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

1. Bridging Depth: 1-1/2 inches.
2. Bridging Clip Angle: Not less than 1-1/2 by 1-1/2 inches; 0.068-inch- base-steel thickness.

G. Rigid Hat-Shaped Furring Channels:

1. Minimum Base-Steel Thickness: 0.0179 inch.
2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum base-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated on Drawings.

2.3 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong World Industries
    b. CertainTeed; SAINT-GOBAIN
    c. USG Corporation

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Post-Installed Anchors: Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES AC193 as appropriate for the substrate.

C. Power-Actuated Anchors: Fastener systems with an evaluation report, acceptable to authorities having jurisdiction, based on ICC-ES AC70.

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF NONSTRUCTURAL METAL FRAMING, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

3.3 INSTALLATION OF NONSTRUCTURAL STEEL FRAMING

A. Install framing system components at spacings indicated on Drawings, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated on Drawings.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated on Drawings.
3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated on Drawings.

B. Install studs so flanges within framing system point in same direction.

C. Install track at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated on Drawings to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated on Drawings.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure unless otherwise indicated on Drawings.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated on Drawings. Install framing below sills of openings to match framing required above door heads.

D. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

E. Installation Tolerances for Nonstructural Steel Framing:

1. Framing Members: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems: Install in accordance with manufacturer's written instructions. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

B. Installation Tolerances for Grid Suspension Systems: Install suspension systems that are level to within 1/8 inch in 12 ft. measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.
3. Sound attenuating insulation
4. Trim accessories.

B. Related Requirements:

1. Section 05 40 00 “Cold Formed Metal Framing”.
2. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.

1.2 DEFINITIONS

A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited

to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide panel products in maximum lengths and widths available that will minimize joints in each area and that correspond with support system specified or indicated on Drawings.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed; SAINT-GOBAIN
2. Georgia-Pacific Gypsum LLC
3. Gold Bond Building Products, LLC provided by National Gypsum Company
4. USG Corporation

B. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Locations: All walls not listed to have other types of wallboards.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M; manufactured with moisture- and mold-resistant core and paper surfaces.

1. Core: 5/8 inch, Type X.
2. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.
3. Long Edges: Tapered.
4. Locations:

a. Walls and partitions in toilet or shower rooms that do not have tile.
b. Walls with plumbing fixtures, such as drinking fountains and at counters with sinks.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325 with manufacturer's standard edges.

1. Thickness: 5/8-inch
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
3. Locations: Showers; wall areas that receive tile.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized-steel sheet or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated on Drawings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fry Reglet Corporation
    b. Gordon Inc.
    c. Pittcon Industries

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Finish: Clear anodized.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M requirements.

1. Mold-Resistant Joint Compound: Use mold-resistant formulations with mold-resistant panel products.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended in writing by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound or drying-type, all-purpose compound.

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C1002 unless otherwise specified or indicated on Drawings.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033- to 0.112-inch thick.

C. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. 3-inches.
2. Subject to compliance with requirements, approved manufacturers include but are not limited to:

    a. Georgia-Pacific Corp.; Sound Control Blanket
    b. Gold Bond Building Products Div., National Gypsum Co.: Glass Fiber Noise Barrier Batt
    c. United States Gypsum Co.; Thermafiber SAFB.

D. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

E. Isolation Strip at Exterior Walls: Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support

framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840 and GA-216 requirements.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16-inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Install sound-attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Gypsum Board, Type X: All walls and ceiling, unless otherwise noted below.
2. Impact-Resistant Gypsum Board: Apply to all wall surfaces less than 8’-0” above the floor.
3. Mold-Resistant Gypsum Board: Restroom walls and ceilings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated on Drawings.
2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise specified or indicated on Drawings or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated on Drawings or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Cementitious Backer Units: ANSI A108.11, at toilet and shower rooms, and locations to receive tile.

D. Water-Resistant Backing Board: Install where with 1/4-inch gap where panels abut other construction or penetrations.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim in accordance with manufacturer's written instructions.

B. Expansion and Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect and as follows:

1. Install expansion joints at locations to coincide with building expansion joints.
2. Install control joints aligned with each door jamb.
3. Install control joints aligned with each side of openings.
4. Locate and install control joints not more than 30-feet apart, horizontally and vertically.
5. Install 40 additional control joints per building, where directed on drawings, or at Architect’s direction.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Install at outside corners unless otherwise specified or indicated on Drawings.
2. LC-Bead: Install at exposed panel edges.
3. L-Bead: Install where indicated on Drawings.
4. U-Bead: Install where indicated on Drawings.

D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 APPLICATION OF JOINT TREATMENT MATERIALS

A. Finishing Panel Products: Treat joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare panel surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints beveled edges, and damaged surface areas.

C. Apply joint tape over panel joints, except for trim products specifically indicated as not intended to receive tape.

D. Interior Gypsum Board: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 5: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting.

3.6 PROTECTION

A. Protect adjacent surfaces from joint compound and promptly remove from floors and other non-gypsum board surfaces. Repair surfaces stained, marred, or otherwise damaged during gypsum board installation and finishing.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glazed wall tile.
2. Waterproof membranes.
3. Setting material.
4. Grout materials.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for sealing of movement joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for tile backing panels.

1.2 DEFINITIONS

A. General: Definitions in ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs.

C. Module Size: Actual tile size plus joint width indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection or shade variation.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Metal flooring transitions 6-inch lengths.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Tiling System: Obtain system products from single manufacturer and each aggregate from single source or producer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ARDEX Americas
    b. Custom Building Products
    c. Laticrete International, Inc.
    d. MAPEI Corporation

2. Obtain setting and grouting materials, except for unmodified portland cement and aggregate, from single manufacturer.
3. Obtain underlayment from manufacturer of setting and grouting materials.
4. Obtain waterproof membrane, crack isolation, and other required membranes from manufacturer of setting and grouting materials.
5. Obtain joint sealants from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.3 GLAZED WALL TILE

A. Glazed Wall Tile Type:

1. Basis-of-Design Product: **Color Wheel Mosaic Hexagon, by Dal-Tile**: Subject to compliance with requirements, provide tile as indicated on Finish Legends in drawings or comparable product by one of the following:

    a. American Olean; a brand of Dal-Tile Corporation
    b. Crossville, Inc.
    c. Interceramic
    d. Marazzi USA; a brand of Dal-Tile Corporation
    e. Vitromex USA, Inc.

2. Module Size: As indicated in Finish Legends in Drawings.
3. Face Size Variation: Cushion edged.
4. Thickness: 1/4-inch.
5. Tile Color and Pattern: As indicated in Finish Legends in Drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.

2.4 FLOOR TILE

1. Basis-of-Design Product: **Caraway, by Concept Surfaces**: Subject to compliance with requirements, provide tile as indicated on Finish Legends in drawings or comparable product by one of the following:

    a. American Olean; a brand of Dal-Tile Corporation
    b. Crossville, Inc.
    c. Interceramic
    d. Marazzi USA; a brand of Dal-Tile Corporation
    e. Vitromex USA, Inc.

2. Module Size: As indicated in Finish Legends in Drawings.
3. Face Size Variation: Rectified.
4. Thickness: 3/8-inch.

5. Tile Color and Pattern: As indicated in Finish Legends in Drawings.
6. Grout Color: As selected by Architect from manufacturer's full range.

2.5 WATERPROOF MEMBRANES

A. General: Manufacturer's standard product that complies with ANSI A118.10 and ANSI A118.12 and is recommended by manufacturer for application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Waterproof Membrane, Fluid Applied: Liquid-latex rubber or elastomeric polymer with continuous fabric reinforcement.

2.6 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to other requirements in ANSI A118.4.

2.7 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.8 MISCELLANEOUS MATERIALS

A. Metal Flooring Transitions and Edge Trim: Profile designed specifically for flooring transitions, wall terminations and edge protection; height to match tile and setting-bed thickness.

1. Manufacturers: Basis of Design: **Finec by Schluter**: Subject to compliance with requirements, provide products by one of the following:

    a. Blanke Corporation
    b. Dural USA, Inc.
    c. Profilitec Corp.
    d. Progress Profiles America Inc.

2. Description: As indicated on drawings.
3. Material and Finish: Metallic or combination of metal and PVC or neoprene base; polished nickel anodized aluminum exposed-edge material.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming

tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Grout Sealer: Grout manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove coatings, including curing compounds or other coatings, that are incompatible with tile-setting materials.

B. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1 and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended

and packaged so tile units taken from one package show same range of colors 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 installing.

E. Substrate Flatness:

1. For tile shorter than 15 inches, confirm that structure or substrate is limited to variation of 1/4 inch in 10 ft. from the required plane, and no more than 1/16 inch in 12 inches when measured from tile surface high points.

3.3 INSTALLATION OF CERAMIC TILE SYSTEM

A. Install tile backing panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

1. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

C. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

1. Add materials, water, and additives in accurate proportions.
2. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

D. Install tile in accordance with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of ANSI A108 series that are referenced in TCNA installation methods and specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
2. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
3. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

a. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

4. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

E. Movement Joints: Provide movement joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Keep joints free of dirt, debris, and setting materials prior to filling with sealants. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

F. Metal Wall Trim: Install at locations indicated on Drawings.

G. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors in accordance with manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile in accordance with tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.5 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:

1. TCNA W245: Thinset mortar on glass-mat, water-resistant gypsum backer board over waterproof membrane.

    a. Ceramic Tile Type: All wall tile applications.
    b. Thinset Mortar: Modified dry-set cement mortar.
    c. Grout: Water-cleanable epoxy grout.
    d. Waterproof Membrane: Fabric-reinforced, fluid-applied membrane.
    e. Joint Width: 3/16-inch.
    f. Movement Joints: As per TCNA EJ171 guidelines.

B. Interior Floor Installations, Slab on Grade

1. TCNA F113-15; Thinset mortar on on-ground concrete.

    a. Ceramic Tile Type: Porcelain, Ceramic, or Quarry floor tile applications.
    b. Thinset Mortar: Modified dry-set cement mortar.
    c. Grout: Water-cleanable epoxy grout.
    d. Waterproof Membrane: Fabric-reinforced, fluid-applied membrane.
    e. Joint width: 1/8-inch.
    f. Movement Joints: As per TCNA EJ171 guidelines.

END OF SECTION 09 30 13

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong World Industries
2. CertainTeed; SAINT-GOBAIN
3. USG Corporation

B. Acoustic Panels:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling; School Zone Fine Fissured or comparable product by one of the following Manufacturers listed above.
2. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

3. Classification: Provide panels as follows:

    a. Type A and Form A1.2: Wet-formed mineral fiber.
    b. Pattern: D (fissured).

4. Colors:

    a. ACT-1 White.
    b. ACT-2 Tech Black

1. Light Reflectance (LR): Not less than 0.80.
2. Ceiling Attenuation Class (CAC): Not less than 40.
3. Noise Reduction Coefficient (NRC): Not less than 0.70.
4. Edge/Joint Detail: Square.
5. Thickness: 3/4 inch.
6. Modular Size: 24 by 24 inches.
7. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested in accordance with ASTM D3273, ASTM D3274, or ASTM G21 and evaluated in accordance with ASTM D3274 or ASTM G21.

2.2 METAL SUSPENSION SYSTEM

A. Exposed Metal Suspension System:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Armstrong Ceiling& Wall Solutions; Prelude XL** or comparable product by one of the following:

    a. CertainTeed; SAINT-GOBAIN
    b. Rockfon; ROCKWOOL International
    c. USG Corporation

2. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.
3. Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60 (Z180), Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch- wide aluminum caps on flanges.

    a. Structural Classification: Heavy-duty system.
    b. Face Design: Flat, flush.
    c. Cap Finish:

        1) ACT-1 - White.
        2) ACT-2 - Black

2.3 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch- diameter bolts.

E. Hold-Down Clips: Manufacturer's standard hold-down.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
9. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. Install panels with pattern running in one direction parallel to long axis of space.
b. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
3. Install hold-down clips in areas indicated; space in accordance with panel manufacturer's written instructions unless otherwise indicated.

a. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 09 65 00 - RESILIENT MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Types of resilient flooring materials specified include:
   1. Resilient floor.

1.2 QUALITY ASSURANCE

A. Resilient materials, including accessories such as underlayment and adhesive, must be free of asbestos.

B. Single Source Responsibility: Products of each resilient flooring system, including primers, underlayments, adhesives and related accessories, must be furnished by a single manufacturer.

C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

D. Flooring Pre-Installation Conference: Approximately one week prior to scheduled commencement of flooring installation and associated work, schedule and meet at project site with flooring installers of each type of flooring and associated work, flooring manufacturer's representatives, and others related with this aspect of the work. Review foreseeable methods and procedures related to roofing work, including but not necessarily limited to the following:
   1. Testing of floor substrates.
   2. Review condition and extent of completion of building interior; readiness for flooring installation.
   3. Review flooring pattern layouts.
   4. Tour representative areas of floor area substrates, inspect and discuss condition and other preparatory work performed by other trades.
   5. Review flooring system requirements and overview of manufacturer’s installation requirements.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product information of each flooring system showing compliance with project requirements.

B. Samples for Verification of Selection: Submit 2 full size of each type of resilient flooring tile samples for verification of selection.
   1. Submit samples of other colors upon request.

1.4 PROJECT CONDITIONS

A. Maintain minimum temperature of 65 ^{0}F (18 C) in spaces to receive resilient materials for at least 48-hours before, during and after installation. Store resilient materials in same conditions for at least 48-hours before the installation.

B. Sequence resilient flooring installation after painting and finishing operations. Ensure that concrete substrates are adequately cured and dry to achieve the bond with adhesive in accordance with manufacturer's requirements.

1.5 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Resilient Flooring: Not less than 5-boxes of each type and color of resilient flooring.

PART 2 - PRODUCTS

2.1 RESILIENT MATERIALS

A. Resilient Floor and Base Products:
   1. Luxury Vinyl Tile (LVT): Basis-of Design product as indicated; Subject to compliance with project requirements.

Wood Pattern Resilient Flooring
   2. Wood Pattern Resilient Flooring: Plank design pattern strips; 3” wide x 36” long.
      a. Basis of Design Selection: **Northern Grain Plank 4.5mm** by Interface
      b. Other Products: Equivalent product by Armstrong, Da Vinci Woodplank by Karndean International, or approved equal.

B. Colors and Patterns:
   1. LVT-1: **Antique Wash**, Ashlar installation pattern.
   2. LVT-2: **Dark Wash**, Ashlar installation pattern.

2.2 INSTALLATION MATERIALS AND ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Crack Suppression Material: Sheet or trowel-on material recommended by manufacturer.

C. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

D. Concrete Slab Primer: Non-staining type as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Make corrections to unsatisfactory conditions.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1,000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in sub-floors.
   1. After filling cracks, apply crack suppression material over as recommended by flooring manufacturer.

D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Perform bond and moisture tests on concrete slabs to determine that concrete surfaces are sufficiently cured, dried and ready to receive flooring. Remove or provide corrective measures to eliminate conditions that will interfere with the bonding of resilient material to substrate.

F. Apply concrete slab primer, if recommended by manufacturer, prior to application of adhesive. Apply in compliance with manufacturer's directions.

G. Perform corrective action to remove surface defects that will telegraph through applied resilient materials.
   1. Building Concrete Slab Construction Joints: Provide crack suppression material over concrete slab construction joints to prevent telegraphing of joints to resilient flooring.

H. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 APPLICATION OF ADHESIVES

A. Mix and apply adhesives in accordance with manufacturer's instructions.

B. Provide safety precautions during mixing and applications as recommended by adhesive manufacturer.

3.4 INSTALLATION – GENERAL

A. Install resilient materials using method indicated in **strict compliance with manufacturer's recommendations**.

B. Extend flooring into toe spaces, door reveals and into closets and similar openings.

C. Install flooring on covers for telephone and electrical ducts and other such items as occur within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed in these covers. Tightly cement edges to perimeter of floor around covers and to covers.

D. Tightly cement flooring to sub-base without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.

E. Hand roll flooring at perimeter of each covered area to assure full adhesion.

F. Base: Make neat joints. Lay out in advance such that length of wall before applying the material. Avoid pieces less than 3 feet (0.9 m) long. Apply to provide continuous appearance.

3.5 RESILIENT FLOORING

A. Lay tile to center of room or space so that the opposite edges of the room are of equal width (unless noted otherwise – Verify with Architect prior to beginning installation. Work toward perimeter. Do not lay tile less than 1/2 the width of a field tile except where accepted by Architect for irregularly-shaped rooms or spaces. Cut border tile or base neatly and accurately to fit 1/64 inch (0.4 mm) of abutting surfaces.

B. Match layout shown in architectural Finish Plan – review with Architect prior to beginning installation.

C. Fit flooring material neatly and tightly into breaks and recesses, against bases, around pipes and penetrations, under saddles or thresholds, and around permanent cabinets and equipment.

D. Lay tile in colors and patterns indicated. Lay tile parallel to room axis in straight courses with cross-joints matching.

3.6 ACCESSORIES

A. Edge Strips: Apply edge strips at door openings where resilient flooring stop and at juncture between resilient flooring and other flooring materials. Secure units to substrate with countersunk stainless-steel anchors, complying with manufacturer's recommendations.
   1. Where resilient flooring terminate at concrete floor substrates, provide saddle thresholds when not specifically addressed in the drawings.

3.7 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting each type of floor tile.
   1. Resilient Flooring with Wear Layer not requiring polish, such as Luxury Vinyl Tile (LVT): Provide protection from damage for remainder of construction period. Replace tile units that are damaged prior to Owner occupancy.

B. Perform the following operations immediately after completing tile installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by tile manufacturers.
   2. Sweep or vacuum floor thoroughly.
   3. Do not wash floor until after time period recommended by resilient floor tile manufacturer.
   4. Damp-mop tile to remove black marks and soil.

C. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by tile manufacturer.
   1. Cover tiles with un-dyed, untreated building paper until inspection for Substantial Completion.
   2. Do not move heavy and sharp objects directly over tiles. Place plywood or hardboard panels over tiles and under objects while they are being moved. Slide or roll objects over panels without moving panels.

D. Clean tiles immediately before inspections intended to establish date of Substantial Completion. Clean tiles using method recommended by manufacturer.

END OF SECTION 09 65 00

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes resilient, rubber, athletic floor surfacing, and accessories for installation, maintenance, and repair.

B. Related work:
   1. Division 3 section, Concrete

1.2 REFERENCES

A. American Society for Testing & Materials (ASTM)
   1. ASTM D297 Standard Practice for Rubber Products - Chemical Analysis ASTM D3676 Standard Specification for Rubber Cellular Cushion used for Carpet or Rug Underlay
   2. ASTM D395 Standard Test Methods for Rubber Property - Compression Set
   3. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
   4. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
   5. ASTM D2240 Standard Test Method for Rubber Property—Durometer Hardness
   6. ASTM D3389 Standard Test Method for Coated Fabrics Abrasion Resistance (Rotary Platform Abrader)
   7. ASTM D6499 Standard Test Method for the Immunological Measurement of Antigenic Protein in Hevea Natural Rubber (HNR) and its Products
   8. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
   9. ASTM E413 Classification for Rating Sound Insulation
   10. ASTM E492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
   11. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
   12. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
   13. ASTM F137 Standard Test Method for Flexibility of Resilient Flooring materials with Cylindrical Mandrel Apparatus
   14. ASTM F386 Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces
   15. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
   16. ASTM F925 Standard Test Method for Resistance to Chemical of Resilient Flooring
   17. ASTM F970 Standard Test Methods for Static Load Limit
   18. ASTM F1344 Standard Specification for Rubber Floor Tile
   19. ASTM F1482 Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring

20. ASTM F1859 Standard Specification for Rubber Sheet Floor Covering Without Backing
21. ASTM F1860 Standard Specification for Rubber Sheet Floor Covering with Backing
22. ASTM F1869 Standard Practice for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
23. ASTM F2055 Standard Test Method for Size and Squareness of Resilient Floor Tile by Dial Gage Method
24. ASTM E2179 Standard Test Method for Laboratory Measurement of the Effectiveness of Floor Coverings in Reducing Impact Sound Transmission Through Concrete Floors
25. ASTM E2180 Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) in Polymeric or Hydrophobic Materials
26. ASTM F2199 Standard Test Method for Determining Dimensional Stability and Curling Properties of Resilient Flooring after Exposure to Heat
27. ASTM F2753 Standard Practice to Evaluate the Effect of Dynamic Rolling Load over Resilient Floor Covering System
28. ASTM F2772 Standard Specification for Athletic Performance Properties of Indoor Sports Floor Systems

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Rubber resilient flooring, manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation installations.
   1. Include manufacturer’s coordination for substrate and preparation of subfloor.

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns, logos, inlays and textures.

C. Samples: Submit selection samples and verification samples for finishes, colors and textures.

D. Closeout Submittal
   1. Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein.

E. Submit manufacturer’s maintenance instructions and literature.
   1. This information shall be included in Operating and Maintenance Manuals, together with warranty certificate at the end of this project.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Recycled rubber athletic flooring components shall be provided by and sourced from a single manufacturer.

2. Blended natural rubber and synthetic rubber athletic flooring components shall be provided by and sourced from a single manufacturer.

B. Installer Qualifications: Installer recognized and approved by the rubber athletic flooring manufacturer. Installer who has specialized in installation of work of similar scale and scope as this project.
   1. Upon request, submit list of a minimum of 3 projects of this athletic flooring.

C. Pre-installation Requirements
   1. Meetings: Conduct pre-installation meeting as needed to verify project requirements, substrate conditions, manufacturer's instruction, and manufacturer's warranty requirements.
   2. Pre-installation Testing: Conduct pre-installation testing to demonstrating compliance of floor substrate meeting manufacturer's installation guidelines.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver and install materials after building is enclosed and protected, surrounding finishing work is completed, including overhead work.

B. Deliver materials in manufacturer's original, unopened and undamaged containers with identification labels intact.

C. Do not damage materials during handling (i.e. edge chipping, excessive warping, etc.).

D. Store materials upright on clean, dry, flat surface protected from damage, and protect from exposure to harmful weather conditions.

E. Comply with manufacturer's environmental conditions for storage; a minimum of 55°F (13°C) or as recommended by the manufacturer.

1.7 JOB CONDITIONS

A. Temperature Requirements: Maintain air temperature in spaces where products are installed for time period before, during, and after installation as recommended by manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

C. Perform installation no sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately twenty-eight (28) days for development of design strength).

D. Moisture vapor emission content of the concrete slab must not exceed the tolerance of the adhesive used, when tested using the anhydrous calcium chloride test as per ASTM F1869.

E. Maintain a secure and clean working area before, during and after installation of rubber athletic flooring.

1.8 COORDINATION

A. Concrete Substrate: Coordinate with concrete work to achieve concrete substrate conditions acceptable to flooring manufacturer.

B. Coordinate to ensure site conditions meet requirements of the rubber athletic flooring manufacturer, as specified herein.

1.9 MANUFACTURER'S GUARANTEE

A. Manufacturer's standard warranty:
   1. GF-1: that the athletic floor material will be free from manufacturing defects for a period of five (5) years from date of Substantial Completion.
   2. RF-1 & RF-2: that the athletic floor material will be free from manufacturing defects for a period of fifteen (15) years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. GF-1: Provide 1 roll, at 48-inches wide, in thickness specified.

B. RF-1 and RF-2: 5% of total installed, per each color. No fewer than 10-tiles each color.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCT (**GF-1**):

A. Manufacturer: Basis-of-Design –**Aktiv Intense, by Regupol America**
   1. Other manufacturers: Mondo, Thor, or approved equal.
   2. Factory sheet / roll surfacing system; 3/8" X 48" Recycled Rubber Flooring.

B. Basis-of-Design Product Description:
   1. Material: Made from 100% recycled SBR (Styrene-Butadiene Rubber) tire rubber
   2. Dimension: 48-inches wide x 3/8-inch thick.
   3. Colors: As selected from manufacturer's full range of standard colors and custom colors.

C. Performance Characteristics:
   1. Wear Surface Density: 60 / 80 pcf
   2. Tensile Strength: ASTM D412, >200 psi min.
   3. Static Load Limit: ASTM F970, 250 psi < 0.001-in.
   4. Fungal Resistance Test: ASTM G21-90, No growth
   5. Coefficient of Friction: ASTM D2047, > 0.95 wet
   6. Impact Insulation: ASTM E492, < 50
   7. Force Reduction: ASTM F2772, 12.9% to 13.7%
   8. Energy Restitution: ASTM F2772, 85% to 86%
   9. Chemical Resistance: ASTM F925, no change
   10. Resistance to Indentation: 0.1mm

11. Vertical Deformation: ASTM F2772 14mm

2.2 MANUFACTURER AND PRODUCT (**RF-1 & RF-2**):

A. Manufacturer: Basis-of-Design –**Norament, 926 Grano, by Interface**
   1. Other manufacturers: Mondo, Flexco, Tarkett, or approved equal.
   2. Factory tile surfacing system; 40x40-inch nominal tile, Homogenous Rubber Flooring.

B. Basis-of-Design Product Description
   1. Material: Made from a blend of natural and synthetic vulcanized rubber.
   2. Dimension: 40x40-inch tiles (nominal).
   3. Colors: As selected from manufacturer's full range of standard colors and custom colors.

C. Performance Characteristics:
   1. Surface: Hammered
   2. Back of Tile: Double sanded smooth
   3. Thickness: 3.5mm
   4. Hardness: ASTM D2240 $\geq$ 70; Shore type A, 82
   5. Static Load: ASTM F970; $\leq$ 0.005; residual compression of 0.005 with 800#
   6. Rolling Load Limit: ASTM F2753; $\leq$ 850psi for forklift traffic, nora polyturethane adhesive is required.
   7. Abrasion Resistance: ASTM D3389 $\leq$ 0.035 oz.; 1.1 lbs load on H-18 wheel with 1000 cycles, 0.002 oz weight loss

2.3 RELATED MATERIALS

A. Patching or leveling compound to be supplied and/or recommended/approved by rubber athletic flooring manufacturer.

2.4 SOURCE QUALITY

A. Source Quality: Obtain recycled rubber resilient flooring materials from a single manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Install athletic flooring after concrete subfloors have been installed a minimum of twenty-eight (28) days.

B. Verify that concrete subfloors are installed over a suitable moisture retardant membrane. Water vapor membrane complies with specification in ASTM E1745.

C. Verify that no concrete sealers or curing compounds are applied or mixed with the subfloors. If curing compounds are present, the subfloor shall be cleaned, mechanically abraded and or resurfaced as required to remove curing compounds and provide a surface acceptable for installation by the flooring manufacturer.

D. Perform moisture and alkalinity tests. Moisture content must not exceed the capacity of the specified adhesive (verify using the anhydrous calcium chloride test as per ASTM F1869) and pH level should be in the range of 7 to 8.5.

E. Verify that concrete subfloor is smooth, dense finish, highly compacted with a tolerance of 1/8-inch in a 1- ft radius.

F. Make corrections to unsatisfactory conditions.

3.2 PREPARATION

A. Prepare concrete subfloor in accordance with manufacturer's subfloor preparation guidelines.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate. Use leveling compound as recommended by flooring manufacturer for filling small cracks and depressions in sub-floors.

C. Clean substrate.

3.3 INSTALLATION

A. Install athletic flooring components in strict compliance with manufacturer's instructions.

3.4 REPAIR

A. Repair material shall be from the same dye lot as material supplied for initial installation.

B. Repairs are to be performed by qualified installers/technicians only.

3.5 CLEANING

A. Perform initial cleaning 72 hours after the rubber athletic surface has been completely installed.

B. Maintain rubber athletic flooring according to manufacturer's current maintenance instructions for specified product.

3.6 PROTECTION

A. Protect athletic flooring surface with manufacturer's recommended covering, such as 1/8-inch Masonite, during and after the installation, prior to acceptance by the Owner.

END OF SECTION 09 65 66

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Type, color, pattern, location, and direction.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of carpet tile.

1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For carpet tile.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft-bind strength.
c. Excess static discharge.
d. Delamination.
e. Dimensional instability.

3. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mannington Commercial; a business unit of Mannington Mills, Inc.
2. Shaw Industries Group, Inc.; Berkshire Hathaway Company
3. Tarkett USA
4. Mohawk Group

2.2 CARPET TILE CPT-1

A. Basis of Design Tile Carpet: **Interface; Etched Earth, Glacier**.

B. Pattern & Color: See Finish Legend in Drawings.

C. Fiber Type: Pet Polyester.

D. Dye Method: 100% Solution Dyed

E. Construction: Engaged tufted pattern loop

F. Pile Thickness: 0.16-inches for finished carpet tile.

G. Total Thickness: 0.362-inches.

H. Tufted Weight: 30 oz./sq. yd. for finished carpet tile.

I. Primary Backing/Backcoating: Manufacturer's standard composite materials – polypropylene.

J. Secondary Backing: Manufacturer's standard material.

K. Backing System: GlasBac® Tile.

L. Size: 39 by 39 inches.

M. Applied Treatments:

1. Soil-Resistance Treatment: Manufacturer's standard treatment

N. Performance Characteristics:

1. Traffic Classification: Severe

2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm in accordance with NFPA 253.
3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
4. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) in accordance with AATCC 16.3 Option 3.
5. Electrostatic Propensity: Less than 3.0 kV in accordance with AATCC 134.

2.3 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and

carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

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

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

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

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

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

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

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl wall film.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.
2. Include data on manufacturer’s recommendations for maximum permissible moisture content of substrates.
3. Include product data for adhesive and any required accessories.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points, include details at control joints, expansion joints, or other joints in substrate.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 265.

2.2 VINLY WALL FILM

A. Basis-of-Design Product: Subject to compliance with requirements, provide **Koroseal, Digitally Printed Vinyl Wallcovering Mural**, or comparable product by one of the following:

1. Arlon Graphics LLC
2. Level Digital
3. Or Prior Approved Equal

B. Description: Permanent wall decorative film with a clear permanent pressure-sensitive adhesive.

C. Film Thickness: 0.018 to 0.026-inches.

D. Fabric Backing: Poly-woven cotton.

E. Finish: **Matte** (150 micron) white vinyl film with a clear permanent pressure-sensitive adhesive.

F. Custom Color / Graphic / Image: Match Architect's selections, See Finish Legend. Architect will provide art file (vector).

2.3 ACCESSORIES

A. Adhesives: Basis of Design: Koroseal A-848-B Heavy-Duty Premixed vinyl adhesive.

B. Substrate Primer / Sealer: White pigmented alkyd or acrylic / latex base primer specifically formulated for use with vinyl wall coverings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Plaster: Allow plaster to cure for at least 90 days. Neutralize areas of high alkalinity. Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Metals: If not factory primed, clean and apply metal primer as recommended in writing by metal-primer manufacturer and wall-covering manufacturer.
4. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
5. Painted Surfaces:

    a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
    b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering/film to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

SECTION 09 72 60 – TACKABLE WALL COVERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient cork / linoleum tackable wallcovering.
2. Accessories.

B. Related Division:

1. DIV 09 Painting, priming for wallcoverings
2. DIV 09 Flexible Vinyl Wallcoverings

1.2 SUBMITTALS

A. Product Data: Identification of manufacturer, pattern name, code, weight, fire rating, dye lot, run sequencing, adhesives, substrate callouts.

B. Installation instructions, including methods to prevent shading lines, and vertical alignment marks.

C. Shop drawings: Elevations with dimensions, seam mapping, corner mapping, pattern mapping, directional data, interface and cutting details, aesthetic balance, and location in project. Indicate horizontal joints or transitions where vinyl meets differing materials.

D. Samples for Initial Selection: For each type of wallcovering indicated in colors, textures, finishes as indicated in Drawings, or from manufacturer's full range, from manufacturer's color card or chips.

E. Samples for Verification: 4-inch square (minimum) for each color, type, or pattern selected.

1.3 QUALITY ASSURANCE

A. Surface Burning Characteristics Classification: Meet ASTM E 84.

B. Single-Source: Obtain trackable wallcovering system components from a single source.

C. Deliver materials in original factory packaging, labeled with manufacturer, brand name, size, color, and lot number.

D. Store materials in original, undamaged packaging inside a well-ventilated area protected from weather, moisture, soiling, and extreme temperatures. Maintain room

temperature within storage area at not less than 68 degrees F during the period materials are stored.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperature within the building of not less than 68 degrees F for a minimum of 72-hiurs prior to beginning of installation.

B. Do not install tackable wallcovering until space is enclosed and weatherproof.

C. Do not install tackable wallcovering until temperature and humidity are stabilized and permanent lighting is in place and operational.

1.5 MAINTENANCE

A. Provide manufacturer's operation and maintenance materials for inclusion in Operation and Maintenance Manuals.

B. Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

1.6 WARRANTY

A. Manufacturer's five-year warranty from date of Substantial Completion, against manufacturing defects.

PART 2 - PRODUCTS

2.1 TACKABLE WALLCOVERING

A. Description: Resilient, tackable, linoleum surface material. Roll goods in 1/4-inch thickness with burlap or similar backing. Through color.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following: **Basis of Design Product: Tac-Wall, by Walltalkers** :

1. Forbo
2. Claridge
3. Plas-cork

C. Accessories: Manufacturer's solvent-free linoleum adhesive and color matched caulk. Trim as selected by Architect from manufacturer's full range of options.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions in which tackable wallcoverings will be installed.

1. Complete finishing operations, including painting, before beginning installation of tackable wallcovering materials.
2. Wall surfaces to receive wall covering materials to be dry and free from dirt, grease, loose paint, and scale.
3. Beginning of installation means acceptance of surface conditions.

3.2 PREPARATION

A. Surface Preparation: Remove hardware, accessories, plates, and similar items to allow tackable wallcovering to be installed.

1. Gypsum Board Surface: Recess nails and screws. Repair irregular tape joints, sand, and remove dust.
2. Painted Surface: Remove loose paint or scale. Sand surface of enamel or glass paint and wipe clean with damp cloth.
3. Ensure wall surfaces scheduled to receive tackable wallcoverings are properly sealed with a quality primer specified for use under flexible vinyl wallcoverings.

3.3 APPLICATION

A. Comply with manufacturer’s printed installation instructions.

B. Cut sheets to size including a few inches of overage. Allow sheets to lay flat for at least 24-hours prior to the application. Mark roll direction and sequence on the backside of each sheet. Hang sheets in sequence as cut from the roll, do not reverse sheets.

C. Permanent HVAC system should be operational and set to 68-degrees F for at least 72-hours prior to, during, and after the installation.

D. Back roll each sheet prior to the installation to release curl memory.

E. For seamed applications, using a seam and strip cutter, remove the factory edge of one sheet. Using the same tool, overlap and trace cut the mating edge of the second sheet. Repeat the is step for as many sheets as required for the bob.

F. Scrive, cut and fit material to bitt tightly to adjacent surfaces, built-in casework, and permanent fixtures and pipes,

G. Apply adhesive with 1/16-inch square notch trowel to the are to receive the sheet. Apply only as much adhesive for one sheet at a time.

H. Work from top to bottom, then side to side. Roll sheet firmly into adhesive for positive

contact and to remove air bubbles.

I. Remove adhesive reside immediately after each panel is hung with a mild soap / water solutions and a soft cloth / sponge.

3.4 CLEANING

A. Clean wallcovering using a sponge with a neutral pH cleaning solution. Do not use abrasive cleaners. Rinse thoroughly with water and let dry before using.

B. It is important to remove adhesive while wet.

3.5 PROTECTION

A. Protect installed product and finish surfaces from damage during construction.

END OF SECTION 09 72 60

SECTION 09 84 00 - ACOUSTICAL WALL AND CEILING TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This section describes
   1. Fabric acoustical wall panels.
   2. Cementitious wood fiber plank acoustical ceiling

1.2 SUBMITTALS

A. Product Data: For each type of material, submit manufacturer's product data with information indicating compliance with project requirements.

B. Color Charts: For each type of material, submit manufacturer's complete range of colors, for selection.

C. Fabric Samples: For each type / texture. Minimum 4-inch by 4-inch.

D. Color Samples: After colors are selected for each type of material, submit manufacturer's samples for verification of selection.

E. Shop Drawings: Layout and details of panels, showing location of items that are to be coordinated with the installation, as required.
   1. For wall-mounted items, include mounting details and dimensioned layout for approval.
   2. For ceiling-mounted items, include coordination drawings indicating coordination of installation of system with adjacent construction and other ceiling-mounted items.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility, Wall Panels: Obtain acoustical wall panels including related accessories from a single manufacturer to provide consistent quality and appearance.

B. Single Source Responsibility, Ceiling Panels: Obtain acoustical panel units and grid components by a single manufacturer.

C. Fire-Test-Response Characteristics: Provide acoustical wall and ceiling panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 450 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver in packages and store in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination or other causes.

B. Before installing units, permit them to reach room temperature and a stabilized moisture content. Stage materials in the space they are to be installed at least 72-hours prior to installation for acclimation.

C. Handle units carefully to avoid damage and stains.

1.5 PROJECT CONDITIONS

A. Do not install acoustical panels until wet-work in space is completed and nominally dry.

1.6 WARRANTY

A. Wall-mounted panels: 10-years from Substantial Completion.

B. Ceiling-mounted panels: 30-years from Substantial Completion.

1.7 MAINTENANCE DATA

A. For inclusion in Owner maintenance manuals, manufacturer’s maintenance data for each product.

1.8 EXTRA MATERIALS

A. Wall Panels – minimum 1-box per each color, texture.

B. Ceiling Panels – 5% of amount installed, full size units, each color installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fabric Acoustical Panels
   1. Basis-of-Design - Manufacturer: Xorel Artform acoustical wall panel units by Carnegie, or approved equivalent.
   2. Acoustical Panels: Fabric faced rPET core.
      a. Composition: High density molded acoustical rPET core.
      b. Fabric wrapped square edges, all sides.
   3. Facing Material: 100% high-performance textile woven from polyethylene yarns.
   4. Panel Sizes: 18-1/2-inches x 16-inches.
   5. Panel Shape: Hexagon, 2-D.
   6. Thickness: 2-inches.
   7. Color of fabric as selected by Architect from manufacturer's complete range of colors in this series. Multiple colors / textures to be selected.

8. Acoustic Performance: NRC 0.80.

B. Cementitious Wood Fiber Planks
1. Surface Texture: Coarse
2. Composition: Wood fibers bonded with inorganic hydraulic cement.
3. Finish: Surface appearance shall be consistent from panel to panel.
4. Color: As selected from manufacturer's full range.
5. Panel Sizes: 48-inches by 96-inches.
6. Thickness: 2-inches.
7. Edge: Square, each side.
8. Attachement Method: C-20; mounted on furring strips to underside of exposed roof deck where indicated on drawings, with manufacturer's recommended fasteners.
9. Site Fit Insulation: 1-inch, 3# density, fiberglass batt insulation tight into open spaces between furring strips.
10. Acoustic Performance: NRC 0.95.

C. Accessories: Manufacturer's concealed hangers, clips, and other recommended items. Use manufacturer's fasteners recommended for substrate provided.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates where panels are to be applied. Check for evenness and levelness. Perform corrective measures if required.

B. Measure each wall area to establish layout of units to balance border widths at opposite edges. Coordinate panel layout with other wall-mounted items.

C. Measure each ceiling area to establish layout of units. Coordinate panel layout with other ceiling-mounted items.

D. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

3.2 INSTALLATION

A. Install acoustical panel and tile systems in accordance with respective manufacturer's instructions.

B. Securely fasten hangers, wall clips, and accessories to substrate.

C. Ensure insulation layer above ceiling-mounted panels rest flush against the back substrate without bunching up beneath the panel edges.

3.3 ADJUST AND CLEAN

A. Clean exposed surfaces, including trim and edge moldings. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

B. Remove and replace items which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 84 00

SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation of substrates and application of the following:

1. Interior and Exterior paint systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat. Submit actual paint drawdowns as specified below for verification Samples.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in applicable exterior painting schedule articles to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match paint products applied and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. 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.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each paint product from single source from single manufacturer.

2.2 PAINTS, GENERAL

A. Paint Systems: Subject to compliance with requirements, provide one of the products listed in applicable painting schedule articles for the paint category indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. PPG Paints; PPG Industries, Inc.
    b. Sherwin-Williams Company (The)
    c. Or Prior Approved Equals.

B. MPI Standards: Provide products complying with MPI standards indicated in applicable exterior painting schedule articles and listed in the "MPI Approved Products List."

C. Material Compatibility:

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

D. Colors: As indicated in a Finish Schedule on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent. Verify that finishing compound is dry and sanded smooth.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers. Proceed with coating application only after unsatisfactory conditions have been corrected.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

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

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove loose rust, loose mill scale, loose shop primer, and other loose foreign matter. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 11.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for interior use in paint system indicated.
2. Sand surfaces that will be exposed to view and remove sanding dust.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION OF PAINT PRODUCTS

A. Apply paints in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides exterior side and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in applicable exterior painting schedule articles may be omitted on items that are factory primed or factory finished if compatible with intermediate and topcoat coatings and acceptable to intermediate and topcoat paint manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed to view:

a. Equipment, including panelboards[and switch gear].
b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.

3.1 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written instructions, apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written instructions.
3. Cost of retesting is Contractor's responsibility.

3.2 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 EXTERIOR PAINTING SCHEDULE, METAL SUBSTRATES

A. Steel and Iron Substrates: MPI EXT 5.1C

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, rust inhibitive, water based, MPI #107.

1) PPG ; Pitt-Tech Plus EP Acrylic Primer @ 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; Pro-Cryl Universal Primer; B66-1300 at 1.9 to 3.8 mils dry per coat.

b. Shop-Applied Prime Coat: Shop primer specified in Section where substrate is specified.
c. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
d. Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level G5), MPI #163.

1) PPG ; Pitt-Tech Plus EP Acrylic DTM Semi-Gloss at 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; DTM Acrylic Semi-Gloss; B66-1150 Series at 2.5 to 4.0 mils dry per coat.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System: MPI EXT 5.3J.

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) PPG ; Pitt-Tech Plus EP Acrylic Primer @ 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; Pro-Cryl Universal Primer; B66-1310 at 1.9 to 3.8 mils dry per coat.

b. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, semigloss (MPI Gloss Level G5), MPI #163.

1) PPG ; Pitt-Tech Plus EP Acrylic DTM Semi-Gloss at 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; DTM Acrylic Semi-Gloss; B66-1150 Series at 2.5 to 4.0 mils dry per coat.

3.4 EXTERIOR PAINTING SCHEDULE, WOOD SUBSTRATES

A. Wood-Based Panel Substrates:

1. Latex over Latex Primer System: MPI EXT 6.4K.

a. Prime Coat: Primer, latex for exterior wood, MPI #6.

1) PPG ; Seal Grip Int/Ext Acrylic Universal Primer/Sealer
2) Sherwin-Williams; Multi-Purpose Latex Primer/Sealer.

b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, (MPI Gloss Level G2), MPI #214.

1) PPG ; Acri-Shield Max Exterior Eggshell @ 1.5 to 1.7 mils dry per coat
2) Sherwin-Williams; Duration Exterior Low Lustre; K30W00200 at 2.2 to 2.6 mils dry per coat.

3.5 INTERIOR PAINTING SCHEDULE, CONCRETE SUBSTRATES

A. Horizontal (Traffic) Surfaces:

1. Water-Based Concrete Floor Sealer System: MPI EXT 3.2H.

a. Prime Coat: Sealer, water based, matching topcoat.
b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

1) PPG ; Perma-Crete Plex Seal WB Interior/Exterior Clear Sealer.
2) Sherwin William; H&C Clarishield Water-Based Wet-Look Sealer.

3.6 INTERIOR PAINTING SCHEDULE, METAL SUBSTRATES

A. Steel and Iron Substrates: MPI EXT 5.1C

1. Water-Based Light Industrial Coating System:

a. Prime Coat: Primer, rust inhibitive, water based, MPI #107.

1) PPG ; Pitt-Tech Plus EP Acrylic Primer @ 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; Pro-Cryl Universal Primer; B66-1300 at 1.9 to 3.8 mils dry per coat.

b. Shop-Applied Prime Coat: Shop primer specified in Section where substrate is specified.
c. Intermediate Coat: Light industrial coating, water based, matching topcoat.
d. Topcoat: Light industrial coating, water based, semigloss (MPI Gloss Level G5), MPI #153.

1) PPG ; Pitt-Tech Plus EP Acrylic DTM Semi-Gloss at 2.0 to 4.0 mils

dry per coat
2) Sherwin-Williams; DTM Acrylic Semi-Gloss; B66-1150 Series at 2.5 to 4.0 mils dry per coat.

B. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Coating System: MPI EXT 5.3J.

a. Prime Coat: Primer, galvanized, water based, MPI #134.

1) PPG; 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel at 3.0 mils dry per coat.
2) Sherwin-Williams; Pro Universal Primer B66-1300 Series at 1.9 to 3.8 mills dry per coat.

b. Intermediate Coat: Light industrial coating, water based, matching topcoat.
c. Topcoat: Light industrial coating, water based, semigloss (MPI Gloss Level G5), MPI #163.

1) PPG ; Pitt-Tech Plus EP Acrylic DTM Semi-Gloss at 2.0 to 4.0 mils dry per coat
2) Sherwin-Williams; DTM Acrylic Semi-Gloss; B66-1150 Series at 2.5 to 4.0 mils dry per coat.

3.7 INTERIOR PAINTING SCHEDULE, WOOD SUBSTRATES

A. Finish Carpentry Substrates: Wood trim.

1. High-Performance Architectural Latex System: MPI INT 6.3A.

a. Prime Coat: Primer, latex, for interior wood, MPI #39.

1) PPG ; Seal Grip Int/Ext Acrylic Universal Primer/Sealer
2) Sherwin-Williams; Multi-Purpose Latex Primer/Sealer.

b. Intermediate Coat: Latex, interior, high-performance architectural, matching topcoat.
c. Topcoat: Latex, interior, high-performance architectural, semigloss (MPI Gloss Level G5), MPI #141.

1) PPG ; Speedhide Int Enamel Latex Semi-Gloss; 6-500 C Series at 1.5 mils dry per coat
2) Sherwin-Williams; All Surface Enamel HP Semi-gloss; Series A41 at 1.6 mils dry per coat.

3.8 INTERIOR PAINTING SCHEDULE, GYPSUM-BASED SUBSTRATES

A. Gypsum Board:

1. Water-Based Light Industrial Coating System: MPI INT 9.2L.

a. Prime Coat: Primer sealer, latex, interior, MPI #50.

   1) PPG ; Superhide Zero Int VOC Latex Sealer; 6-4900XI at 1.4 mils dry per coat
   2) Sherwin-Williams; ProMar 200 Zero Interior Latex Primer;B28W12600 at 1.0 mils dry per coat.

b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.

c. Topcoat: Light industrial coating, water based catalyzed epoxy, (MPI Gloss Level G3), MPI #215 or 115.

   1) PPG ; Aquapon WB EP Epoxy Semi-Gloss; 98-X/98E-100 at 2.0 to 4.0 mils dry per coat
   2) Sherwin-Williams; Pro Industrial Water Based Catalyzed Epoxy; B73-300/B73V00300 at 2.0 to 4.9 mils dry per coat.

END OF SECTION 09 90 00

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Dimensional Characters for building identification indicated on building elevations (interior and exterior).
   2. Cast-metal building plaque.
   3. Panel signs for rooms, direction and fire evacuation plans.

1.2 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.

B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
   1. Dimensional Characters: Full-size sample of dimensional character (letter) for each size, color, and finish required.
   2. Cast Metal Plaque:
      a. Initial message layout on paper to scale, or full size.
      b. Furnish full-size rubbings on paper.
   3. Room Panel Sign: Submit full size sample for verification of color, pattern, design and texture selected, and compliance with requirements indicated. If accepted and approved, this sample may be incorporated into the project.
   4. Fire Evacuation Plans: Submit printed drawings of each building floor plan with room names. Coordinate with Architect for location; indicate "YOU ARE HERE" mark in distinctive color on each plan.

C. Room Panel Sign Schedule:
   1. Schedule a meeting with Owner and Architect for room name and numbering. Do not use room name and numbering in the Drawings.
   2. Prepare building plan drawings with room name and numbering from information gathered at this meeting. Develop and submit room signage schedule together with these building plan drawings. Indicate room signage with printed message inserts.
   3. After receiving submittal comments develop and submit printed message list for each room panel sign for final review and approval.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of signage manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain each sign type through one source from a single manufacturer.

C. Regulatory Requirements: Comply with the Americans with Disabilities Act (ADA) and with code provisions as adopted by authorities having jurisdiction.

1.4 PROJECT CONDITIONS

A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements on Shop Drawings.

1.5 COORDINATION

A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.
   1. For signs supported by or anchored to permanent construction, furnish templates for installation of anchorage devices.

B. Forward final approved building plan drawings with room name and numbers to door hardware supplier. Final room numbering for identifying keying.

PART 2 - PRODUCTS

2.1 DIMENSIONAL CHARACTERS – INTERIOR SIGNAGE

A. Cutout Characters (Interior Signage): Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

B. Manufacturers:
   1. ASI Sign Systems, Inc.
   2. Best Signs
   3. Gemini Incorporated
   4. Or prior approved equal.

C. Material: Laminated sheet acrylic with laminated acrylic facing.
   1. Colors: As indicated on Drawings.
   2. Character Height: As indicated on Drawings.
   3. Thickness: As indicated on Drawings.
   4. Mounting: As indicated on Drawings.

D. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

E. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.2 DIMENSIONAL CHARACTERS – EXTERIOR SIGNAGE

A. Aluminum Castings (Exterior Signage): Aluminum castings of alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Manufacturers:
   1. ASI Sign Systems, Inc.
   2. Best Signs
   3. Gemini Incorporated
   4. Or prior approved equal.

C. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

E. Characters: Form individual letters and numbers by casting. Produce characters with smooth flat faces, sharp corners, and precisely formed lines and profiles, free from pits, scale, sand holes, and other defects. Cast lugs into back of characters and tap to receive threaded mounting studs. Comply with requirements indicated for finish, style, and size.

F. Characters: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
   1. Character Material:
   2. Character and Font Style, Height and Strokes as indicated in Drawings.

G. Anchors and Inserts: Use stainless steel anchors and inserts for exterior installations as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors.

H. Finish for Letters: As indicated in drawings.

2.3 CAST-METAL PLAQUE

A. General: Provide castings free from pits, scale, sand holes, and other defects. Comply with requirements specified for metal, border style, background texture, and finish and in required thickness, size, shape, and copy.

B. Manufacturers:
   1. ASI Sign Systems, Inc.
   2. Best Signs
   3. Gemini Incorporated
   4. Metal Arts; Div. of L&H Mfg.
   5. Or prior approved equal

C. Cast-metal Plaque: Refer to attachment at the end of this specifications section for layout and message. Coordinate with Architect for final location. Install near main building entry at location to be indicated by Architect.
   1. Aluminum Casting: Aluminum casting of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
   2. Size: 18x24-inches
   3. Border Style: Single Line
   4. Background Texture: Manufacturer's standard stipple finish.
   5. Mounting: Concealed studs for substrates encountered.

D. Cast-Metal Plaque Finishes:
   1. Raised Areas: Hand-tool and buff borders and raised copy to produce manufacturer's standard satin aluminum finish.
   2. Background Finish: Paint, matte finish, from manufacturer's full range.

2.4 PANEL SIGNS

A. General: Provide panel signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally.

B. Manufacturers:
   1. Andco Industries Corp.
   2. APCO Graphics, Inc.
   3. ASI Sign Systems, Inc.
   4. Best Manufacturing Co.
   5. 2/90 Sign Systems
   6. Or prior approved equal

C. Description of Panel Signs: Design and size as indicated in drawings.
   1. Material: Cast-acrylic sheet.
   2. Copy: Tactile and Braille surface.
   3. Font Type and Size as indicated. If not indicated, provide 1" tall, 1/8" stroke, Century Gothic, all upper case letters.

D. Types of Panel and Egress Signs: The following types of panel signs are required.
   1. Room Panel Signs: One by door to each room. Where rooms have more than one door, provide same number of identical signs as the number of doors to the rooms.
      a. Panel signs with alpha-numeric characters for room number and room name identification.
      b. Toilet Rooms: Panel sign with picture symbol (Men or Women) sign for each toilet room, including access symbol. Provide message indicated below-
         1) Include message "Men" or "Women" for student toilet rooms.
         2) Include message "Men (Staff only)" or "Women (Staff only)" for staff and teachers' toilet rooms.
   2. Wayfinding-Directional Signs
   3. Egress & Fire Evacuation Plans: 18" x 24" size, indicating building plan in black lines, exit routes with red line arrows. Art file to be provided by Architect.
   4. Exit Signs: Same design as room panel signs. At interior side of each building exit door to the exterior, provide code required sign with "EXIT" message with raised Braille.

E. Cast-Acrylic Sheet: Manufacturer's standard and as follows:
   1. Transparent Sheet: Where sheet material is indicated as "clear," provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested in accordance with the requirements of ASTM D 1003.
   2. Opaque Sheet: Where sheet material is indicated as "opaque," provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

a. Color: To match 3Form's resin panel "Varia Struck Chamomile" and "Varia Smudge N37".

F. Graphic Content and Style: Provide sign copy that complies with requirements indicated in the Sign Schedule for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

G. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
1. Panel Material: Opaque acrylic sheet.
2. Raised-Copy Thickness: Not less than 1/32 inch (0.8 mm).

H. Colored Coatings for Acrylic Sheet: For colors, provide Pantone Matching System (PMS) colored coatings, including inks and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are non-fading for application intended.

2.5 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined.
1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior installations, furnish stainless-steel devices unless otherwise indicated.
3. Sign Mounting Fasteners:
a. Concealed Studs: Concealed, threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.
4. Inserts: Furnish inserts to be set by other trades into concrete or masonry work.

B. Double-Sided Adhesive Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch (1.14 mm) thick, with adhesive on both sides.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Protect mechanical finishes on exposed surfaces from damage by applying strippable, temporary protective covering before shipping.
2. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
   2. Verify that items, including anchor inserts, provided under other sections of Work are sized and located to accommodate signs.

B. Make corrections to unsatisfactory conditions.

3.2 INSTALLATION

A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
   2. Room-Identification Signs and Other Accessible Signage: Install in locations on walls as indicated and according to accessibility standard.
   3. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches (75 mm) of sign without encountering protruding objects or standing within swing of door.

B. Dimensional Characters: Mount characters using fastening methods recommended by manufacturer for character form, type of mounting, wall construction, and condition of exposure indicated. Provide templates to establish character spacing and to locate holes for fasteners.
   1. Projected Mounting: Mount characters at projection distance from wall surface.

C. Cast-Metal Plaque: Mount plaque using standard fastening methods recommended in writing by manufacturer for type of wall surface.
   1. Location: As selected by Architect – coordinate in the field.
   2. Concealed Mounting: Mount plaque by inserting threaded studs into tapped lugs on back of plaque. Set in predrilled holes filled with quick-setting cement.

D. Wall-Mounted Panel Signs:
   1. Shim-Plate: Provide 1/8-inch- (3-mm-) thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate.
   2. Attach room panel signs to plate using double-sided foam tape method.
   3. Where panel signs are mounted on glass, provide matching plate on opposite side of glass to conceal mounting materials.

3.3 CLEANING AND PROTECTION

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or

components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish.

D. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

3.4 SIGN SCHEDULE

A. Dimensional Letters: As indicated in Drawings.

B. Emergency Egress/Wayfinding Signs: Locations as indicated in Drawings; or if not indicated, provide 6 signs per building, locations as directed by Architect.

C. Egress & Fire Evacuation Plans: Locations as indicated in Drawings; or if not indicated, provide 8 signs per building, locations as directed by Architect.

D. Room Panel Signs
1. 1 by each door to each room.

E. Exit Signs
1. 1 at each exit to exterior.

END OF SECTION 10 14 00

SECTION 10 21 13 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes toilet compartments and screens for toilet rooms as follows:
   1. Type: Solid-plastic, HPDE.
   2. Compartment Style: Overhead braced and floor anchored.
   3. Urinal Screen Style: Wall and Floor anchored.

1.2 SUBMITTALS

A. Submit product data for toilet compartment and screen assemblies specified. Include details of construction relative to materials, fabrication, and installation. Include details of anchors, hardware, and fastenings.

B. Submit shop drawings for fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.

C. Color Samples for Selection: Submit manufacturer's color samples for selection.

1.3 QUALITY ASSURANCE

A. Single-source Responsibility: Provide toilet compartments, screens, panels and related hardware from a single manufacturer.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 DESCRIPTION, PRODUCT AND MANUFACTURER

A. Description of Product:
   1. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1-inch (25 mm) thick, seamless, with eased edges, and with homogenous color and pattern throughout thickness of material.
      a. Minimum Class B finish classification, to comply with code requirements.
      b. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.

c. Color and Pattern: As indicated in Drawings; or as selected from manufacturer's color chart.

B. Manufacturer: Subject to compliance with project requirements, provide products by the following or approved equal -
1. Ampco Products, Inc.
2. Bobrick Washroom Equipment, Inc.
3. Bradley
4. Columbia
5. Scranton

C. Hardware Manufacturer: Special super/extra heavy-duty hardware components are specified below. These hardware components are available from sources listed in Hardware article below if toilet compartment manufacturers do not have hardware that meet the requirements of this project.

2.2 MATERIALS, GENERAL

A. Provide materials selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, irregular marks, stains, discolorations, or other imperfections on finished units are unacceptable.

B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A 743 / A 743M.

2.3 OTHER MATERIALS

A. Pilaster Shoes: ASTM A167, Type 302 or 304 stainless steel, minimum 4-inch high, 18 gauge, #3 directional polish finish, attached with stainless steel through bolts.

B. Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312-inch (0.8 mm) thick and 3-inches (75 mm) high, finish to match hardware.

C. Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

D. Floor-Anchored Screens: Provide pilasters and panels of same construction and finish as toilet compartments. Provide manufacturer's standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

E. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
1. Continuous Brackets: Full Height (57.5-inch) Extruded 6063-T5 Aluminum with a Satin Anodized finish. Minimum weight 1.685 pounds per lineal foot. Inside of opening of bracket 0.50-inch for panels, 0.75-inch for pilasters. Pre-drill holes for mounting to wall and panel/pilaster. Space holes at 9-inches o.c. along the full

length of the bracket for a total of 14 holes for mounting to the wall and 7 holes for mounting to the panel/pilaster. Minimum wall thickness of 0.125-inch for brackets.

2. Full Hi Aluminum by Columbia Partitions, or approved equal.

F. Hardware and Accessories: Heavy-duty operating hardware and accessories of stainless steel.

G. Overhead Bracing (Headrail): Continuous heavy duty extruded 6063-T5 aluminum headrail with anti-grip profile. Headrail with integral reinforcing channel. Satin anodized finish. Provide headrail corner brackets, wall brackets, and headrail end caps. The headrail and headrail brackets shall have a minimum wall height of 2-inch. The minimum wall thickness of the headrail and headrail brackets shall be 0.125-inch.

H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. General: Doors, panels, screens, and pilasters fabricated for compartment systems. Provide units with cutouts and drilled holes to receive compartment-mounted hardware and accessories.

B. Overhead-Braced-and-Floor-Anchored Compartments: Manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Screens: Units in sizes of same construction and finish as compartments.

D. Doors: Unless otherwise indicated, provide 24-inch wide in-swinging doors for standard toilet compartments. 36-inch wide doors with a minimum of 32-inches wide clear opening for partitions to be handicap accessible, or at handicap accessible fixtures.

E. Hardware: Manufacturer’s extra / super heavy duty of cast metal –

1. Hinges: Continuous 14 Gauge Stainless Steel Hinge (57.5-inches). 3-wide hinge with 5 stainless steel wire springs for self-closing action. Pivot pin 0.250-inch in diameter, of Type 302/304 stainless steel. Hinges shall provide emergency access by lifting the door. Pre-drill hinges for mounting to door and pilaster. Mounting holes at 9-inch o.c. for through-bolting with stainless steel fasteners.
   a. Full Hi ST/ST by Columbia Partitions, or approved equal.
2. Strike and Keeper: Heavy duty cast stainless steel with satin finish. 2.5-inch high strike and keeper with the mounting holes at 1.50-inch o.c., and the wall thickness a minimum of 0.125-inch. The strike and keeper shall with integral rubber bumper door stop. Furnish one per door.
3. Slide Latch: Heavy duty cast stainless steel with satin finish. Slide Latch surface mounted. The slide bar 0.15-inch thick, 1.02-inch wide and 3.72-inch long. Latch with internal Stainless Steel buffering spring to prevent damage when door is inadvertently slammed against the Latch. Mounting holes are to be spaced at

3.50-inch o.c. Latch knob riveted to the slide bar and then welded to insure that the knob will not come off. Furnish one per door.

4. Coat Hook: Heavy duty cast stainless steel with satin finish. Coat Hook and Bumper 2.34-inches high, 1.23-inches wide and protrude out from the door 3.05-inches. The hook portion shall have a finished diameter of 0.25-inch. Furnish one per door.
5. Door Stop: Heavy duty cast stainless steel with satin finish. Plated Zamac Door Stops are unacceptable. Door Stop shall have a 2.125-inch base diameter and protrude 1.8-inches from the wall. Bumper at the end of the Door Stop shall be 0.25-inch thick. The diameter of the shaft shall be 0.6875-inch. Furnish one for each Disabled Accessible door.
6. Pull Handle: Heavy duty cast stainless steel with satin finish. Plated Zamac Door Pulls are unacceptable. Pull Handle shall protrude from the face of the door 0.940-inch and shall be 4.735-inches long. Pull Handle with mounting holes drilled and tapped for 10 / 24 threads at 3.5-inches o.c. The Pull Handle shall be 0.655-inch wide and shall be mounted back to back with the Slide Latch. Furnish one for each Disabled Accessible door.
7. Door Hardware: Cast ST / ST by Columbia Partitions, or approved equal. Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
8. Hardware Sources: Following are some sources capable of furnishing above hardware:
    a. Galaxy Hardware; P.O. Box 8843, Columbia, SC 29202 (803-799-2423).
    b. Harris Hardware; 4 Harbor Park Drive, Port Washington, NY 11050 (516-484-4440).
    c. Jacknob Hardware, Inc.; 290 Oser Avenue, Hauppauge, NY 11788 (516-321-9933).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
    1. Confirm location and adequacy of blocking and supports required for installation.

B. Make corrections to unsatisfactory conditions.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2-inch (13 mm) between pilasters and panels and not more than 1-inch (25 mm) between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.

B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Compartments: Set pilaster units with anchors penetrating not less than 2-inches (50 mm) into structural floor, unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

E. Accessories: Mount accessories in accordance with manufacturer's instructions.

3.3 ADJUSTING AND CLEANING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched.

B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 10 21 13

SECTION 102239 – OPERABLE ACOUSTICAL PANEL PARTITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Automatic vertically retractable acoustic panel partition.

B. Related Requirements:

1. DIV 05 for structural steel
2. DIV 09 for wall and ceiling framing at head, jambs, and pockets.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for operable partition, components and accessories.

B. Shop Drawings: Show location and extend of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Partition supports and bracing, and storage layout.
2. Suspended ceiling components.
3. Structural members to which suspension systems will be attached.
4. Items penetrating finished ceiling including the following:

a. Lighting fixtures.
b. HVAC ductwork, outlets, and inlets.
c. Smoke detectors.

D. Samples: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:

1. Textile Facing Material: Full width by not less than 36-inch- long section of fabric from dye lot to be used for the Work, with specified treatments applied. Show complete pattern repeat.
2. Panel Edge Material: Not less than 3 inches long.

1.4 INFORMATIONAL SUBMITTALS

A. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of operable panel partition.

D. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.

E. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:

    a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
    b. Seals, hardware, track, track switches, carriers, and other operating components.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.7 QUALITY ASSURANCE

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

B. Acoustical Performance: Acoustical performance shall be tested at a laboratory

accredited under the National Voluntary Laboratory Accreditation Program (NVLAP) and in accordance with ASTM E90 Test Standards.

C. Preparation of the opening shall conform to the criteria set forth as per ASTM E557 “Standard Practice for Architectural Application and Installation of Operable Partitions.”

D. Operable wall assembly must be manufactured by a certified ISO-9001-2015 company or equivalent quality control system.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer’s direction and as required to prevent damage.

1.9 WARRANTY

A. Special Warranty: Provide a written warranty. Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period, excluding abuse.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties in accordance with test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance in accordance with ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.

B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested in accordance with NFPA 265 Method B Protocol or NFPA 286.

2.2 OPERABLE ACOUSTICAL PANEL PARTITIONS

A. Automatic Vertically Retractable Acoustical Panel Partitions: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following, Basis of Design Product: **Acousti-Seal® Legacy® Paired Panel System 932, STC 50, by Modernfold, Inc.**

    a. Hufcor
    b. Kwik Wall
    c. Panelfold

B. PANEL CONSTRUCTION

1. Nominal 3-inch thick panels in manufacturer's standard 48-inch widths. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
2. Panel Skin: Roll-formed 21-gage steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction 50STC.
3. Hinges for Closure Panels:

    a. Concealed laminated hinge with antifriction segments mounted between each heat-treated link. Hinge to be attached directly to panel frame. Welded internal hinge bracket shall support the hinge and allow for adjustment of hinge plates. Lifetime warranty on hinges. Concealed hinges mounted into panel edge or vertical astragal are not acceptable.

4. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove at panel joints.
5. Panel Weights: 8lbs. / sf.

C. Panel Finish shall be:

1. Acoustical, non-woven needle punch carpet, with fused fibers to prevent unraveling or fray of material.
2. Panel Trim: As selected from manufacturer's full range.

2.3 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed steel astragals, with reversible tongue in groove configuration in each panel edge for universal panel operation. Rigid plastic or aluminum astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contracting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal Bottom Seals: Manually activated seals, providing nominal 2-inch operating clearance with an operating range of +1/2-inch to -1-1/2-inch. Seal shall be operable from panel edge or face. Extended seal shall exert nominal 120 lbs. downward force to the floor throughout the operating range.

2.4 SUSPENSION SYSTEM:

A. Suspension Tracks: Track shall be structural aluminum. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 3/8-inch (9.5 mm) diameter threaded rods.

1. Exposed track soffit: Track soffit to be integral to track shape and shall be powder-coated off white paint finish. Track must accommodate termination of plenum sound barriers on both sides of track for maximum sound control.
2. Carriers: One trolley per panel with 3-inch (76 mm) diameter glass-reinforced nylon all steel precision-ground ball-bearing wheels. Steel-wheeled or reinforced polymer trolleys on aluminum track not permitted. Trolleys shall attach to panels with 1/2-inch (13 mm) diameter pendent bolt mounted to welded steel mounting plate.
3. Warranty period: Ten (10) years.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions.

B. Make corrections to unsatisfactory conditions.

3.2 INSTALLATION

A. General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. The complete installation of the operable wall system shall be by an authorized factory-trained installer, and be in strict accordance with the approved shop drawings and manufacturer's standard printed specifications, instructions, and recommendations.

D. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

E. Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.3 CLEANING AND PROTECTION

A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.4 ADJUSTING

A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.

B. Lubricate hardware and other moving parts.

3.5 DEMONSTRATION and training

A. Schedule and demonstrate proper operation and maintenance procedures to Owner's representative.

B. Provide Operation and Maintenance Manual during closeout procedures.

END OF SECTION 10 22 39

SECTION 10 28 00 – TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Staff-use shower room accessories.
3. Custodial accessories.

1.2 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

A. Product Data: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Include electrical characteristics.

B. Samples: For each exposed product and for each finish specified, full size.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.

D. Sample Warranty: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, visible silver spoilage defects.
2. Warranty Period: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:

1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASI-American Specialties, Inc.
2. Bobrick Washroom Equipment, Inc
3. Bradley Corporation
4. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.

C. Paper Towel Dispenser: Owner Furnished, Owner Installed.

D. Sanitary-Napkin Disposal Unit: Owner Furnished, Owner Installed.

E. Toilet Paper Dispensers: Owner Furnished, Owner Installed.

F. Soap Dispenser: Owner Furnished, Owner Installed.

G. Grab Bar:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model B-6806.99** or comparable product by one of the manufacturers listed above.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.

a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.

4. OD: 1-1/2 inches.
5. Configuration and Length:

    a. Toilets Rooms and Stalls: As indicated on Drawings. Straight, 36 inches long and 42 inches long, vertical bar 18-inches long.
    b. Roll-In Shower: As indicated on Drawings. Straight, 48 inches long and 24 inches long, vertical 18-inch long.

H. Mirror Unit:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model B-2909** or comparable product by one of the manufacturers listed above.
2. Mirror: 1/4" (6mm) thick. Two pieces of 1/8" (3mm) select float glass, selected for silvering and laminated with 0.015'' (0.381mm)thick clear vinyl in the center, and electrolytically copper-plated by the galvanic process
3. Frame: Stainless steel.

    a. Corners: Mitered and welded.

4. Size: 24-inches by 36-inches.
5. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

2.3 STAFF-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain staff-use shower room accessories from single source from single manufacturer. See list of approved manufacturers in Public-Use Washroom Accessories

B. Shower Curtain Rod:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model B-6107** or comparable product by one of the manufacturers listed above.
2. Description: 1-inch-OD, straight rod.
3. Configuration: As indicated on Drawings.
4. Length: 60-inch.
5. Mounting Flanges: Concealed fasteners; in material and finish matching rod.
6. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model 204-3** or comparable product by one of the manufacturers listed above.
2. Size: Minimum 12 inches wider than opening by 72 inches high.
3. Material: Vinyl, minimum 0.008 inch thick, opaque, matte.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Stainless steel, spring wire curtain hooks with snap

fasteners **(Bobrick Model 204-1)**, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Robe Hook:

1. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model 6777** or comparable product by one of the manufacturers listed above.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
4. Quantity Required: 2 per shower. Coordinate locations with Architect in the field.

2.4 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Custodial Mop and Broom Holder:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ASI-American Specialties, Inc.
    b. Bobrick Washroom Equipment, Inc
    c. Bradley Corporation
    d. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.

2. Basis-of-Design Product: Subject to compliance with requirements, provide **Bobrick; Model 224x36** or comparable product by one of the manufacturers listed above.
3. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
4. Length: 36 inches.
5. Hooks: Four.
6. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
7. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

    a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.
    b. Rod: Approximately 1/4-inch- diameter stainless steel.

2.5 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch- minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B19, flat products; ASTM B16/B16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B30, castings.

C. Steel Sheet: ASTM A1008/A1008M, Designation CS (cold rolled, commercial steel),

0.036-inch- minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

G. Chrome Plating: ASTM B456, Service Condition Number SC 2 (moderate service).

H. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.6 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of **six** keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION OF TOILET, BATH, AND LAUNDRY ACCESSORIES

A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 00 - FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Fire extinguishers.
2. Fire extinguisher cabinets
3. Fire extinguisher mounting brackets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
2. Include rough-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type and materials, trim style, door construction, panel style, and materials.

B. Samples: For each type of exposed finish required.

C. Product Schedule: For fire extinguishers, fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Use same designations indicated on Drawings.

1.3 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

B. Coordinate sizes and locations of fire protection cabinets with wall depths

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. JL Industries; Activar Construction Products Group, Inc.
    b. Larsen's Manufacturing Company

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard.
4. Handles and Levers: Manufacturer's standard.
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

1. Basis of Design is JL Industries Cosmic 10E

2.4 FIRE-PROTECTION CABINET

A. Manufacturers: Subject to compliance with requirements, provide products by one of the listed in in fire extinguishers section above.

1. Basis of Design is **JL Industries Academy Architectural Series, Model #1027**.

B. Fire-Protection Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Nonrated.

D. Cabinet Material: Cold-rolled steel sheet.

E. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).

1. Rolled-Edge Trim: 3-inch backbend depth.

F. Cabinet Trim and Door Material: Aluminum sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Tempered float glass (clear).

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting door pull and friction latch.
2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

J. Accessories:

1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated below.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet glazing.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: As selected by Architect from manufacturers full color range.
4) Orientation: Vertical.

K. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range.

2. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.

a. Finish: Baked enamel or powder coat.
b. Color: As selected by Architect from full range of industry colors and color densities.

3. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.5 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer. See approved manufacturers listed in fire extinguishers above.

2.6 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Miter corners and grind smooth.
3. Provide factory-drilled mounting holes.
4. Prepare doors and frames to receive locks.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Identification:

1. Apply vinyl lettering at locations indicated.

3.4 INSTALLATION OF FIRE EXTINGUISHER MOUNTING BRACKETS

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

3.5 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 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.

END OF SECTION 10 44 00

SECTION 10 44 33 – AUTOMATED EXTERNAL DEFIBRILLATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public access automated external defibrillators (AEDs), alarming wall-mounted cabinets, and signage.

1.2 COORDINATION

A. Coordinate requirements for blocking, reinforcing, and other supports concealed within wall to ensure that units can be supported and installed as indicated.

1.3 REFERENCES

A. FDA – Food and Drug Administration Medical Device Regulations

B. AHA – American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.

C. OSHA – Occupational Safety and Health Administration standards.

1.4 ACTION SUBMITTALS

A. Product Data: Manufacturer’s technical data sheets, installation instructions.

B. Certifications: Provide documentation verifying FDA pre-market approval (PMA).

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: for AEDs.

B. Owner Training: Provide manufacturer’s representative for Owner training on all devices. Provide minutes of meeting and sign-in sheet to Owner during closeout.

1.6 WARRANTY

A. Manufacturer’s Standard Warranty: Manufacturer agrees to repair, restore, or replace work that fails in materials or workmanship within specified warranty period.

1. Warranty Period: 10 years(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Stryker (Physio-Control)
2. Zoll Medical Corporation
3. Phillips Healthcare

2.2 AUTOMATED EXTERNAL DEFIBRILLATOR (AED) REQUIREMENTS

A. Operation: Semi-automatic or fully automatic external defibrillator with voice and visual prompts guiding the responder through the rescue process.

B. Waveform: Biphase truncated exponential or rectilinear biphasic waveform.

C. Energy Output: Scaled or escalating energy sequence up to at least 150 joules for adults.

D. Pediatric Capability: Must support pediatric rescue via specialized pads, a pediatric key, or a toggle switch.

E. Self-Testing: Automatic daily, weekly, and monthly self-t5ests of internal circuitry, software, and battery / pad readiness. Status indicator must be visible without turning the device on.

F. IP Rating: Minimum IP55 rating for dust and water protection to ensure durability in varied environments.

G. Data Storage: Internal memory capable of recording ECG data and event logs for review.

2.3 CONSUMABLES

A. Defibrillation Pads: Minimum 2-year shelf life, pre-gelled, self-adhesive, disposable, non-polarized electrodes.

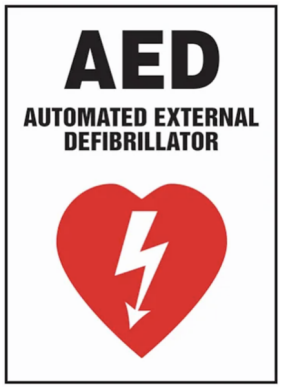
B. Battery Pack: Minimum 4-year standby life after installation, capable of delivering a minimum of 125 full-energy shocks.

2.4 AED CABINET AND SIGNAGE

A. Cabinet Type: Surface-mounted or semi-recessed, heavy-duty steel wall cabinet with a clear acrylic viewing window.

B. Alarm System: Battery-powered audible alarm, 85dB minimum, that triggers automatically when the cabinet door is opened.

C. Signage: 3D highly visible projection wall sign (V-shape or 90-degree bend labeled AED with the universal style heart-and-lightning bolt icon.







PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify wall surfaces and blocking are ready to receive the cabinet and that mounting heights comply with all accessibility guidelines and standards.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Height: Mount the AED cabinet so that the highest operable part / handle is no higher than 48-inches above the finished floor to comply with accessibility standards.

B. Location: As indicated in the Drawings, and / or confirmed by Owner and Architect in the field.

C. Mounting: Securely fasten cabinets to walls and blocking behind, according to manufacturer's installation instructions.

D. Signage: Install the 3-D wall sign directly above the cabinet at a minimum height of 84-inches above the finished floor for optimal visibility.

3.3 FIELD QUALITY CONTROL AND CLEANING

A. Inspection: Confirm the AED battery and pads are properly connected and that the device status indicator shows a "ready" state.

B. Cleaning: Clean all visible surfaces of the cabinet and window prior to final handover.

END OF SECTION 10 44 33

SECTION 10 56 13 - METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes metal storage shelving.

1.2 SUBMITTALS

A. Submit product data for metal storage shelving.

1.3 QUALITY ASSURANCE

A. Single-Source Responsibility: Obtain metal storage shelving from one source from a single manufacturer.

PART 2 - PRODUCTS

2.1 METAL STORAGE SHELVING

A. Product & Manufacturer: Extra Heavy Duty Shelving by Global Industrial™, or approved equal.

B. Description: Extra heavy duty metal storage shelving.
   1. 48”W x 24”D x 72”H with 5 wire shelves.
   2. Color: Gray.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that wet work and building finish work is complete, building environmental system is operational before delivering and installing metal shelving.

3.2 INSTALLATION

A. Follow manufacturer's printed instructions for assembling shelving units.

B. Place units level and plumb at locations indicated.

C. Secure side by side units together.

D. Clean and touch-up marred surfaces.

END OF SECTION 10 56 13

SECTION 10 73 00 - EXTRUDED ALUMINUM COVERED WALK SYSTEM & CANOPY

PART 1 - GENERAL

1.1 SUMMARY

A. This section includes fabricated extruded aluminum wall hung canopies.

1.2 PERFORMANCE REQUIREMENTS & DESIGN CRITERIA

A. Structural Performance: Provide covered walkway systems capable of withstanding the effects of gravity loads, applicable local code loading conditions, and the following loads and stresses within limits and under conditions indicated.
   1. Wind Load: ASCE-7 for uniform pressure for wind speed indicated in Drawings.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data of materials and accessories indicating compliance with these requirements, drainage, anchorage and accessory items.

B. Shop Drawings: Submit scaled and dimensioned shop drawings for fabrication and erection of each type and configuration of canopies and walkways.

C. Submit manufacturer's information and/or calculations demonstrating that the system will be able to withstand code required loads. Clearly indicate components, tables and code required loads (i.e. live, dead and wind).
   1. Delegated-Design: Comply with performance requirements and design criteria, including analysis data signed and sealed by a licensed professional engineer in the State of this project.

1.4 QUALITY ASSURANCE

A. Single Source: Covered walkway systems and canopies including anchorage items shall be furnished by one manufacturer for the entire project.

B. Manufacturer Qualifications: A firm experienced in manufacturing covered walk systems and with a record of successful in-service performance.
   1. Engineering Responsibility: Preparation of Shop Drawings and engineering analysis by a qualified professional engineer.

C. Delegated Design Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of metal building systems that are similar to those indicated for this Project in material, design, and extent.

D. Installer Qualifications: Installer, which firm has no fewer than 5 years of successful experience with installation metal roof systems similar to those required for this Project,

who is trained and approved by the roof system manufacturer, for installation of manufacturer-warranted systems.

PART 2 - PRODUCTS

2.1 COVERED WALKS - MANUFACTURERS, MATERIALS, AND FABRICATION

A. Manufacturer: Subject to compliance with project requirements, provide canopy system by one of the following, or approved equal:
1. ACR Extruded System
2. AllState Canopies
3. AVADek
4. E. L. Burns, Inc.
5. Gulf South Metals
6. Mapes
7. Mitchell Metals
8. Perfection Architectural Systems, Inc.
9. Peachtree Protective Covers.
10. Rusco Canopies

B. Materials:
1. Aluminum Members: Extruded aluminum rigid bents, fascia gutter and deck sections; 6063 T-6 aluminum alloy; members sized to withstand live, dead and installation loads.
2. Fasteners: Aluminum or 18-8 stainless steel as recommended by manufacturer.
3. Grout: 2,000 psi compressive strength.

C. Extruded Aluminum Framing Members:
1. Column (-downspouts): 6 x 6-inches square, unless indicated otherwise.
2. Beam (-gutters): 6 x 8-inches, unless indicated otherwise.

D. Deck: Interlocking modules fastened creating a monolithic structural unit.
1. Deck Profile Thickness: 6-inches, unless indicated otherwise.

E. Fabrication: Edges and sections neatly cut, true and smooth. Factory-weld with neatly mitered corners, smooth and uniform welds with 100% weld penetration.
1. Provide end closures of same thickness material as canopy, fully welded 3 sides to provide completely sealed open ends of drainage channels.
2. Fabricate canopy system to drain precipitation from deck to gutter/fascia/beam and to spout outlets.

2.2 WALL-HUNG CANOPY

A. Prefabricated deck, fascia/gutter with drainage spouts and support brackets as indicated in the drawings.

B. Fabrication: Construct canopy for positive drainage. Design canopy to withstand code required live load of 20 psf, construction loads and indicated and wind loading.
1. Attachments and Bolts: Stainless steel, size recommended by manufacturer for installation indicated.

2.3 FINISH

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Different Finishes are for this project.
   1. Canopies and Covered Walks:
      a. Class I, Clear Anodic Finish: AA-M12C22A41 Class I, 0.018 mm, or thicker.

2.4 MISCELLANEOUS

A. Flashings at Walls: 0.040" thick aluminum or 24-ga stainless steel, finish to match canopy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumb and level in accordance with manufacturer's instructions and as indicated.

B. Where deck is located over beam gutters, provide drainage openings approximate full width of beam gutter and drainage channel. Drilled holes or small punch-outs are inadequate and not acceptable.

C. Set roof decks and fascia/gutters for positive drainage away from building for discharge at drain spouts.

D. Protect surfaces of aluminum in contact with concrete with clear acrylic or other protective coating recommended by manufacturer.

E. Where canopies abut walls, provide continuous metal flashings along juncture between canopy and wall.
   1. Seal at juncture and where anchorage penetrate wall to maintain watertightness of installation.
   2. Extend metal flashing a minimum of 3" past each end of the canopy.
   3. Provide sealant as indicated. Sealant is specified in Division 7 Section.

F. Clean surfaces upon completion. Touch-up marred surfaces.

END OF SECTION 10 73 00

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 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.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified this section.
   1. Minimum three years experience.

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.

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 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:
   1. Sleeve Length: 1 inch (25 mm) above finished floor.
   2. Provide sealant for watertight joint.

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. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall, Floor, Partitions, and Beam Flanges: 1 inch (25 mm) greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Flexicraft Industries: www.flexicraft.com/#sle.
   2. The Metraflex Company: www.metraflex.com/#sle.
   3. Or approved equal.

B. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
   2. Watertight seal between pipe and wall-sleeve, wall or casing opening.
   3. Size and select seal component materials in accordance with service requirements.
   4. Service Requirements:
      a. Corrosion resistant.
      b. Oil, fuel, gas, and solvent resistant.
      c. Underground, buried, and wet conditions.
   5. Glass-reinforced plastic pressure end plates.

C. Sealing Compounds:
   1. Provide packing and sealing compound to fill pipe to sleeve thickness.
   2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

D. Pipe Sleeve Material:
   1. Bearing Walls: Steel, cast iron, or terra-cotta pipe.
   2. Masonry Structures: Sheet metal or fiber.

E. Wall Sleeve: PVC material with waterstop collar, and nailer end-caps.

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. Structural Considerations: Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
   1. 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 (15 mm) where penetrations occur between conditioned and unconditioned spaces.
   2. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

F. 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.

G. 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

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

B. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 220553 - Identification for Plumbing Piping and Equipment.

B. Section 220719 - Plumbing Piping Insulation.

C. Section 221005 - 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. PFA: Perfluoroalkoxy alkane.

G. PTFE: Polytetrafluoroethylene.

H. RS: Rising stem.

I. TFE: Tetrafluoroethylene.

J. WOG: Water, oil, and gas.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

C. MSS SP-45 - Drain and Bypass Connections; 2020.

D. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010, with Errata .

E. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

F. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.05 SUBMITTALS

A. See Section 013000 - 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.

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.

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. Secure check valves in either the closed position or open 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. Handle large valves with sling, modified to avoid damage to exposed parts.

B. 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. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:
   1. Shutoff: Ball.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:
   1. Copper Tube:
      a. 2 inch (50 mm, DN) and Smaller: Threaded ends except where solder-joint or pess valve-end option is indicated in valve schedules below.

F. Domestic, Hot and Cold Water Valves:
   1. 2 inch (50 mm, DN) and Smaller:
      a. Bronze and Brass: Provide with solder-joint, threaded, or press ends.
      b. Ball: Two piece, full port, brass or bronze with bronze trim.

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 inch (150 mm, DN) and smaller.

D. Insulated Piping Valves: With 2 inch (50 mm, DN) 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. Solder-joint Connections: ASME B16.18.

G. Potable Water Use:
   1. Certified: Approved for use in compliance with NSF 61 and NSF 372.
   2. Lead-Free Certified: Wetted surface material includes less than 0.25 percent lead content.

H. Valve Bypass and Drain Connections: MSS SP-45.

I. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRASS, BALL VALVES

A. Two Piece, Full Port with Brass Trim and Female Thread, Male thread, or Solder Connections:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi (1035 kPa).
3. CWP Rating: 200 psi (1379 kPa).
4. Body: Forged DZR brass, low lead compliant.
5. Seats: PTFE or TFE.
6. Leak and Blow-out Proof Stem: Stainless Steel.
7. Ball: Stainless steel.
8. Operator: Lever handle and stem extension.
9. Manufacturers:
   a. Apollo Valves: www.apollovalves.com/#sle.
   b. Effebi: www.effebi.com/#sle.
   c. FNW: www.fnw.com/#sle.
   d. Mueller Streamline, Co: www.muellerstreamline.com/#sle.
   e. Or approved equal.

B. Two Piece, Full Port with Press Connections:
1. CWP Rating: 200 psi (1379 kPa).
2. Body: Dezincification-resistant brass.
3. Seats: PTFE.
4. Ball: Stainless steel.
5. Leak and Blowout Proof Stem: DZR brass or stainless steel.
6. Operator: Provide lever handle and stem extension.
7. Maximum Service Temperature: 250 degrees F (121.1 degrees C).
8. Manufacturers:
   a. Effebi; Gladiator Press: www.effebi.com/#sle.
   b. FNW; 430: www.fnw.com/#sle.
   c. Mueller Streamline, Co; Series 7700: www.muellerstreamline.com/#sle.
   d. Or approved equal.

2.04 BRONZE, BALL VALVES

A. General:
1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. Two Piece, Full Port with Bronze Trim:
1. Comply with MSS SP-110.
2. WSP Rating: 150 psi (1035 kPa).
3. CWP Rating: 400 psi (2758 kPa).
4. Body: Forged bronze or dezincified-brass alloy.
5. Ends Connections: Pipe press, thread, or solder.
6. Seats: PTFE or TFE.
7. Stem: Bronze, blowout proof.
8. Ball: Stainless steel.
9. Operator: Provide lever handle and stem extension.
10. Manufacturers:
    a. Apollo Valves: www.apollovalves.com/#sle.
    b. FNW: www.fnw.com/#sle.
    c. NIBCO INC: www.nibco.com/#sle.
    d. Or approved equal.

2.05 BRASS, INLINE CHECK VALVES

A. Class 150:
   1. CWP Rating: 200 psi (1380 kPa).
   2. Maximum Service Temperature: 250 degrees F (121.1 degrees C).
   3. Body: DZR brass or stainless steel.
   4. Disc: DZR brass or stainless steel.
   5. Seal: PTFE, bubble-tight.
   6. End Connections: Press, solder, or threaded.

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.

END OF SECTION

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prefabricated trapeze-framed systems.

B. Strut systems for pipe or equipment support.

C. Beam clamps.

D. Pipe hangers.

E. Pipe supports, guides, shields, and saddles.

F. Nonpenetrating rooftop supports for low-slope roofs.

G. Anchors and fasteners.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications.

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 A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

I. 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.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. MFMA-4 - Metal Framing Standards Publication; 2004.

M. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

N. 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 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. 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.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. 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 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. 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.

D. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.

E. Materials for Metal Fabricated Supports: Comply with Section 055000.
1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

F. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.
1. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
2. Outdoor, Damp, or Wet-Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

2.02 PREFABRICATED TRAPEZE-FRAMED SYSTEMS

A. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Manufacturers:

a. Anvil International, LLC: www.asc-es.com/#sle.
b. Gripple, Inc: www.gripple.com/#sle.
c. Unistrut, a brand of Atkore International, Inc: www.unistrut.com/#sle.
d. Or equal.
e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.

2. MFMA-4 compliant, pre-fabricated, MSS SP-58 Type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
3. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
4. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 1-5/8 inch (41 mm) height.
7. Accessories: Provide bracket covers, clamps, conduit clamps, fire-retarding brackets, j-hooks, protectors, and vibration dampeners.

2.03 STRUT SYSTEMS FOR PIPE OR EQUIPMENT SUPPORT

A. Strut Channels:
   1. Manufacturers:
      a. ABB Installation Products: electrification.us.abb.com/#sle.
      b. Gripple, Inc: www.gripple.com/#sle.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
      d. Or equal.
      e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
   2. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or plumbing equipment support.
   3. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

B. Hanger Rods:
   1. Threaded zinc-plated steel unless otherwise indicated.
   2. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch (13 mm, DN) diameter.
      b. Piping up to 2 inch (50 mm, DN): 3/8 inch (10 mm, DN) diameter.
      c. Piping 2-1/2 inch (64 mm, DN) to 3 inch (75 mm, DN): 1/2 inch (13 mm, DN) diameter.
      d. Piping 4 inch (100 mm, DN) to 5 inch (127 mm, DN): 5/8 inch (16 mm, DN) diameter.
      e. Piping 6 inch (153 mm, DN): 3/4 inch (19 mm, DN) diameter.
      f. Trapeze Support for Multiple Pipes: 1/2 inch (13 mm) in diameter.

C. Channel Nuts:
   1. Provide carbon steel channel nut with epoxy copper or zinc finish and long, regular, or short spring.

2.04 BEAM CLAMPS

A. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.

B. C-Clamp: MSS SP-58 type 23, malleable iron and steel with zinc finish.

C. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish. For inverted usage provide manufacturer listed size(s).

D. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with plain finish.

E. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with plain finish.

F. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

2.05 PIPE HANGERS

A. Band Hangers, Adjustable:
   1. MSS SP-58 type 7 or 9, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

B. J-Hangers, Adjustable:
   1. MSS SP-58 type 5, zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.

C. Swivel Ring Hangers, Adjustable:
   1. MSS SP-58 type 10, epoxy-painted, zinc-colored.
   2. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

D. Clevis Hangers, Adjustable:
   1. Copper Tube: MSS SP-58 type 1, epoxy-plated copper.
   2. Standard-Duty: MSS SP-58 type 1, zinc-colored, epoxy plated.

2.06 PIPE CLAMPS

A. Riser Clamps:
   1. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.
   2. MSS SP-58 type 1 or 8, carbon steel or steel with epoxy plated, stainless steel, or zinc plated finish.
   3. Medium Split Horizontal Pipe Clamp: MSS SP-58 type 4, carbon steel or stainless steel with epoxy plated, stainless steel, or zinc plated finish.
   4. Copper Tube Pipe Clamp: MSS SP-58 type 8, epoxy plated copper.

B. Extension Split Pipe Clamp:
   1. MSS SP-58 type 12, hinged split ring and yoke roller hanger with epoxy copper or zinc finish.
   2. Material: ASTM A47/A47M malleable iron or ASTM A36/A36M carbon steel.
   3. Provide hanger rod and nuts of the same type and material for a given pipe run.
   4. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

C. Strut Clamps:
   1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with epoxy copper or zinc finish.
   2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil (26,398,000 V/m).
   3. Service Temperature Range: Minus 65 to 275 degrees F (Minus 53.8 to 135 degrees C).

D. Insulation Coupling:
   1. Two bolt-type clamps designed for installation under insulation.
   2. Material: Carbon steel with epoxy copper or zinc finish.

2.07 PIPE SUPPORTS, GUIDES, SHIELDS, AND SADDLES

A. 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.

B. U-Bolts:

1. MSS SP-58 type 24, carbon steel u-bolt for pipe support or anchoring.

C. Pipe Shields for Insulated Piping:
   1. MSS SP-58 type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
   2. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: galvanized steel.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
      d. Service Temperature: Minus 40 to 178 degrees F (Minus 40 to 81 degrees C).
      e. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

D. Pipe Supports:
   1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
   2. Liquid Temperatures Up to 122 degrees F (50 degrees C):
      a. Overhead Support: MSS SP-58 types 1, 3 through 12 clamps.

E. Pipe Supports, Thermal Insulated:
   1. General 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 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.
      c. Provide pipe supports for 1/2 to 6 inch (13 to 75 mm, DN) iron pipes.
      d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by 360 degree, PVC jacketing.

2.08 NONPENETRATING ROOFTOP SUPPORTS FOR LOW-SLOPE ROOFS

A. Manufacturers:
   1. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
   2. PHP Systems/Design: www.phpsd.com/#sle.
   3. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   4. Or approved equal.

B. Provide steel pedestals with thermoplastic or rubber base 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.

C. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

D. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.

E. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

2.09 ANCHORS AND FASTENERS

A. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

B. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

C. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

D. Hollow Masonry: Use toggle bolts.

E. Hollow Stud Walls: Use toggle bolts.

F. Steel: Use beam ceiling clamps, beam clamps, machine bolts, or welded threaded studs.

G. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with stainless steel or zinc finish.

H. Sheet Metal: Use sheet metal screws.

I. Wood: Use wood screws.

J. Plastic and lead anchors are not permitted.

K. Powder-actuated fasteners are not permitted.

L. Hammer-driven anchors and fasteners are not permitted.

M. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

N. Preset Concrete Inserts: Continuous metal strut channel and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   1. Channel Material: Use galvanized steel.
   2. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm) minimum base metal thickness.
   3. Manufacturer: Same as manufacturer of metal strut channel 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. 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. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. 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.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Underground warning tape.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 099123 - 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 013000 - Administrative Requirements for submittal procedures.

B. Schedules:
   1. Submit plumbing component identification schedule listing equipment, piping, and valves.
   2. Detail proposed component identification data in terms of of wording, symbols, letter size, and color coding to be applied to corresponding product.
   3. Valve Data Format: Include id-number, location, function, and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
   1. Heat exchangers, water heaters, and other heat transfer products.
   2. Control panels, transducers, and other related control equipment products.
   3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.

B. Tags:
   1. Piping: 3/4 inch (20 mm) diameter and smaller.
   2. Manual operated and automated control valves.
   3. Instrumentation, relays, gauges, and other related control equipment products.
   4. Ceiling tacks placed on lay-in ceiling surface to reference plumbing components.

C. Pipe Markers: 3/4 inch (20 mm) diameter and higher.

2.02 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch (6 mm).
   3. Background Color: Black.
   4. Nameplate Height: 3/4 inch (19 mm).
   5. Nameplate Material:
      a. Flexible: Vinyl with adhesive backing per ASTM D709.
      b. Metal: Brass with center-side holes for screw fastening.

2.03 TAGS

A. Metal: Brass, 19 gauge 1-1/2 inch (40 mm) in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

B. Piping: 3/4 inch (20 mm) diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

C. Underground Flexible Marker: Bright-colored, continuously printed, magnetically detectable ribbon tape, minimum 6 inches (150 mm) wide by 5 mil (0.13 mm) thick, multi-layer laminate construction with solid aluminum foil core encased between protective plastic film layers, manufactured for direct burial service. APWA color-coded (Yellow for gas, Blue for potable water) with continuous printed warning legend.

D. Identification Scheme, ASME A13.1:
   1. Primary: External Pipe Diameter, Uninsulated or Insulated.
      a. 3/4 to 1-1/4 inches (19 to 32 mm): Use 8 inch (203 mm) field-length with 1/2 inch (13 mm) text height.
      b. 1-1/2 to 2 inches (38 to 51 mm): Use 8 inch (203 mm) field-length with 3/4 inch (19 mm) text height.
      c. 2-1/2 to 6 inches (64 to 152 mm): Use 12 inch (305 mm) field-length with 1-1/4 inch (32 mm) text height.
   2. Secondary: Color scheme per fluid service.
      a. Flammable and Oxidizing Fluids: Black text on yellow background.
      b. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.
   3. Tertiary: Other Details.
      a. Directional flow arrow.

2.05 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 5 mil, 0.005 inch (0.12 mm), unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:
   1. Tape for Buried Gas Lines: Black text on yellow background.
   2. Tape for Buried Water Lines: White text on blue background.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

B. Color code as follows:
   1. Plumbing Equipment: Yellow.
   2. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

E. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at both sides of floor and wall penetrations.
   4. Place pipe marker every 25 to 50 feet (7.6 to 15.2 m) interval of straight run.

F. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass fiber insulation.

B. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2025.

B. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2023).

C. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

F. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three 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 INSULATION

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.

4. Or approved equal.

B. Insulation: ASTM C547 and ASTM C795; rigid, preformed pipe insulation, noncombustible.
   1. K (Ksi) Value: 0.24 at 75 degrees F (0.035 at 24 degrees C).
   2. Maximum Service Temperature: 850 degrees F (454 degrees C).
   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 (0.029 ng/(Pa s m)).

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.03 JACKETING AND ACCESSORIES

A. PVC Plastic Jacket:
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
      b. Or equal.
   2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F (Minus 18 degrees C).
      b. Maximum Service Temperature: 150 degrees F (66 degrees C).
      c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/(Pa s m)), maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil, 0.010 inch (0.25 mm).
      e. Connections: Brush on welding adhesive.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Reinforced Tape:
   1. All Service Jacket tape suitable for sealing seams between insulation, insulated pipe bends, and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723 or ASTM E84.
   3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   4. Finish: Match insulation.

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. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. 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 matching butt strips with pressure-sensitive adhesive and vapor barrier mastic. Do not use staples or mechanical fasteners that puncture the vapor retarder.
   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.

E. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

F. 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.

G. Inserts and Shields:
1. Application: Piping 1-1/2 inches (40 mm) 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 (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: High-density polyisocyanurate cellular plastic or rigid closed-cell foam, minimum 6.0 lb/cu ft (96 kg/cu m) density, with factory-applied vapor retarder jacket matching adjacent pipe insulation.

H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

I. Pipe Exposed in Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Plumbing Systems:
1. Domestic Hot Water Supply and Recirculation:
a. Glass Fiber Insulation: 1 inch thick.
2. Domestic Cold Water:
a. Glass Fiber Insulation:
1) Pipe Size Range: Up to 1 inch (25 mm).
(a) Thickness: 1/2 inch (13 mm).
2) Pipe Size Range: 1-1/4 inch (32 mm) and larger.
(a) Thickness: 1 inch (25 mm).
3. Roof Drain Bodies and Horizontal Runs at Roof Level:
a. Glass Fiber Insulation: 1 inch thick.
4. Plumbing Vents Within 10 Feet (3 Meters) of the Exterior:
a. Glass Fiber Insulation: 1 inch thick.

END OF SECTION

SECTION 221005 - PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet (1500 mm) of building.
B. Sanitary waste piping, above grade.
C. Domestic water piping, buried within 5 feet (1500 mm) of building.
D. Domestic water piping, above grade.
E. Storm drainage piping, buried within 5 feet (1500 mm) of building.
F. Storm drainage piping, above grade.
G. Pipe flanges, unions, and couplings.
H. Pipe hangers and supports.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.
B. Section 099123 - Interior Painting.
C. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
D. Section 220719 - Plumbing Piping Insulation.
E. Section 312316 - Excavation.
F. Section 312323 - Fill.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
C. ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; 2021.
D. ASME B31.9 - Building Services Piping; 2025.
E. ASTM B32 - Standard Specification for Solder Metal; 2020.
F. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
G. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.
H. ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2024.
I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.
J. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2026.
K. ASTM C1277 - Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.
L. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020 (Reapproved 2024).
M. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2025.
N. 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).
O. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

Q. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2026.

R. AWWA C651 - Disinfecting Water Mains; 2023.

S. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

T. 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.

U. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

V. IAPMO/ANSI/CAN Z1117 - Standard for Press Connections; 2022.

W. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

Y. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

Z. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

AA. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

BB. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

CC. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

DD. NSF 372 - Drinking Water System Components - Lead Content; 2024.

EE. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements 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.

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 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 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, solder, and flux (if used), complying with NSF 61 and NSF 372; label pipe and fittings.

B. Plenum-Installed Piping: Provide piping with flame spread index of 25 or less and smoke developed index of 50 or less when tested in accordance with ASTM E84 or UL 723.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY WASTE PIPING, ABOVE GRADE

A. 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 (1500 MM) OF BUILDING

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (Type A), soft annealed.
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: Run continuous tubing without joints.
      a. Where joints below slab are unavoidable: AWS A5.8M/A5.8, brazed.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
   1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
   2. Joints: ASTM B32 solder.
   3. Mechanical Press Sealed Fittings: ASME B16.51 or IAPMO/ANSI/CAN Z1117, ICC (IPC), and IAPMO (UPC) approved, NSF 61 and NSF 372 certified, with EPDM seals.
      a. Manufacturers:
         1) Apollo Valves: www.apollovalves.com/#sle.
         2) Mueller Streamline, Co: www.muellerstreamline.com/#sle.
         3) NIBCO INC: www.nibco.com/#sle.
         4) Or approved equal.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.07 STORM DRAINAGE 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.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch (80 mm, DN) and Under:
   1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. No-Hub Couplings:
   1. Testing: In accordance with ASTM C1277 and CISPI 310.
   2. Gasket Material: Neoprene complying with ASTM C564.
   3. Band Material: Stainless steel.
   4. Eyelet Material: Stainless steel.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.09 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 inch (80 mm, DN): Cast iron hook.
   4. Wall Support for Pipe Sizes 4 inch (100 mm, DN) and Over: Welded steel bracket and wrought steel clamp.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch (15 to 40 mm, DN): Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 inch (50 mm, DN) and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 to 4 inch (50 to 100 mm, DN): Carbon steel, adjustable, clevis.
   4. Wall Support for Pipe Sizes Up to 3 inch (80 mm, DN): Cast iron hook.
   5. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Floor Support for Hot Pipe Sizes to 4 inch (100 mm, DN): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
   7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
   4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
   5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
   6. Other Types: As required.

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 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.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
   1. See Section 220719.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 083100.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.
   1. See Section 099123 for painting of interior plumbing systems and components.

L. Excavate in accordance with Section 312316.

M. Backfill in accordance with Section 312323.

N. Install water piping to ASME B31.9.

O. 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.

P. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Q. Sleeve pipes passing through partitions, walls, and floors.

R. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Provide copper plated hangers and supports for copper piping.
   7. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
      a. Painting of interior plumbing systems and components is specified in Section 099123.
   8. Support cast iron drainage piping at every joint.

S. 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.

D. Provide spring-loaded check valves on discharge of water pumps.

E. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Water Piping: Slope at minimum of 1/32 inch per foot (1:400) and arrange to drain at low points.

3.06 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
   1. Perform hydrostatic testing for leakage prior to system disinfection.
   2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
   3. General:
      a. Fill the system with water and raise static head to 10 psi (345 kPa) above service pressure. Minimum static head of 50 to 150 psi (345 to 1,034 kPa). As an exception, certain codes allow a maximum static pressure of 80 psi (551.6 kPa).

C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. 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).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. 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.

3.08 SERVICE CONNECTIONS

A. Provide new sanitary and storm 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 approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer.
   1. Provide 18 gauge, 0.0478-inch (1.21 mm) galvanized sheet metal sleeve around service main to 6 inch (150 mm) above floor and 6 feet (1800 mm) minimum below grade. Size for minimum of 2 inches (50 mm) of loose batt insulation stuffing.

3.09 SCHEDULES

A. Pipe Hanger Spacing:
   1. Copper Tubing:
      a. Pipe Size: 1/2 inch (15 mm, DN) to 1-1/4 inch (32 mm, DN):
         1) Maximum Hanger Spacing: 6 ft (1.8 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 1-1/2 inch (40 mm, DN) to 2 inch (50 mm, DN):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
   2. Cast Iron, Hubless:

a. All sizes:
    1) Maximum Hanger Spacing: 5 ft (1.5 m).
    2) Hanger Rod Diameter: 3/8 inches (9 mm).

3. PVC:
    a. Pipe Size: 1/2 inch (15 mm, DN) to 1-1/2 inch (40 mm, DN):
        1) Maximum Hanger Spacing: 3 ft (0.9 m).
        2) Hanger Rod Diameter: 3/8 inches (9 mm).
    b. Pipe Size: 2 inch (50 mm, DN) to 6 inch (150 mm, DN):
        1) Maximum Hanger Spacing: 4 ft (1.2 m).
        2) Hanger Rod Diameter: 3/8 inches (9 mm).

END OF SECTION

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backflow preventers.

B. Vacuum breakers.

C. Water pressure reducing valves.

D. Mixing valves.

E. Strainers.

F. Hydrants.

G. Drain valves.

H. Water-hammer arrestors.

I. Trap primers.

1.02 ABBREVIATIONS AND ACRONYMS

A. DZR: Dezincification resistant.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems; 2015 (Reaffirmed 2025).

B. ASSE 1003 - Water Pressure Reducing Valves for Potable Water Distribution Systems; 2023.

C. ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2025.

D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.

E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.

F. ASSE 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations; 2017 (Reaffirmed 2021).

G. ASSE 1018 - Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied; 2023.

H. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.

I. ASSE 1052 - Performance Requirements for Hose Connection Backflow Preventers; 2023.

J. ASSE 1053 - Performance Requirements for Dual Check Backflow Preventer Wall Hydrants - Freeze Resistant Type; 2019 (Reaffirmed 2023).

K. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

L. AWWA C511 - Reduced-Pressure Principle Backflow Prevention Assembly; 2017 (Reaffirmed 2021).

M. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

N. NSF 372 - Drinking Water System Components - Lead Content; 2024.

O. PDI-WH 201 - Water Hammer Arresters; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

C. Maintenance Materials: Furnish the following for Owner's use in project maintenance:

1. See Section 016000 - Product Requirements for additional provisions.
2. Extra Loose Keys for Hydrants: Two.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Protect end connections, flanges, threads, and grooves from dirt and damage.

F. Protect product interiors against rust and corrosion.

G. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products complying with NSF 61 and NSF 372.

B. Source Limitations: Furnish domestic water piping specialties of same kind by same manufacturer.

C. Provide brass-bodied domestic water piping specialties in DZR brass.

2.02 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers:
      a. Watts: www.watts.com/#sle.
      b. Wilkins by Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. NPS 2 (DN 50) and Smaller:
      a. Assembly: ASSE 1013 and AWWA C511.
      b. Backflow Valve: Manufactured from bronze, copper silicon alloy, or stainless steel.
      c. Isolation Valves: Ball valves on inlet and outlet.
      d. Maximum Working Pressure: 175 psi (12.1 bar).
      e. Working Temperature Range: 33 to 180 degrees F (0.5 to 82 degrees C).
      f. Accessories:
         1) Air gap fitting.
         2) Flood detection sensor.
         3) Inlet strainer.

B. Hose-Connection Backflow Preventers:
   1. Valve: ASSE 1052, brass, nonremovable once installed, drainable, with hose-thread end connections.
      a. Provide with chrome finish when associated faucet, hose bibb, or hydrant is specified in chrome.
   2. Maximum Working Pressure: 125 psi (8.6 bar).
   3. Working Temperature Range: 33 to 180 degrees F (0.5 to 82 degrees C).

2.03 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:
   1. Valve: ASSE 1011, brass, nonremovable, drainable, with hose-thread end connections.
   2. Maximum Working Pressure: 125 psi (8.6 bar).
   3. Working Temperature Range: 33 to 180 degrees F (0.5 to 82 degrees C).

B. Water Heater Vacuum Relief Valve
   1. Valve: ANSI Z21.22 , lead-free brass or bronze body, automatic atmospheric vacuum relief, tested and rated per CSA 4.4, with male inlet and female outlet connections.
   2. Maximum Working Pressure: 200 psi (13.8 bar).
   3. Maximum Temperature: 250 degrees F (121 degrees C).
   4. Installation: Install on cold water supply line, elevated a minimum of 6 inches (150 mm) above the highest point of the water heater tank, in accordance with manufacturer instructions.

2.04 WATER PRESSURE REDUCING VALVES

A. Direct-Acting Pressure Reducing Valves:
   1. Manufacturers:
      a. Watts: www.watts.com/#sle.
      b. Wilkins by Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. Valve: ASSE 1003, bronze or copper silicon alloy body, with spring-loaded diaphragm; field-adjustable outlet pressure, and integral inlet screen strainer.
      a. Diaphragm: EPDM or buna-nitrile.
      b. Spring: Stainless steel.
      c. Provide with single union ends.
   3. Maximum Working Pressure: 300 psi (20.7 bar).
   4. Outlet Pressure Range: 15 to 75 psi (100 to 515 kPa).
   5. Working Temperature Range: 33 to 140 degrees F (0.5 to 60 degrees C).

2.05 MIXING VALVES

A. Water Temperature Limiting Valves:
   1. Manufacturers:
      a. Wilkins by Zurn Water, LLC: www.zurn.com/#sle.
      b. Watts: www.watts.com/#sle.
      c. Or approved equal.
   2. Valve: ASSE 1070, bronze body; thermostatic element; corrosion- and lime-resistant internal components; integral locking temperature adjustment with high-temperature limit stop; integral check valves with strainer screens on inlets.
   3. Mixed-Water Temperature Setting: 105 degrees F (40.5 degrees C).

B. Automatic Compensating Valves for Individual Showers and Combination Tub-Showers:
   1. Valve: ASSE 1016, pressure balancing, brass or bronze body with inlet checkstops; integral volume and temperature control with adjustable high-temperature limit stop.
   2. Valve Trim: Escutcheon with ADA-compliant lever handle.

2.06 STRAINERS

A. NPS 2 (DN 50) and Smaller:
   1. Body: Wye-pattern in bronze.
   2. Screen: Stainless steel mesh.
   3. Pressure Rating: 200 psi (13.8 bar).

2.07 HYDRANTS

A. Wall Hydrants:
   1. Manufacturers:
      a. Woodford Manufacturing Company: www.woodfordmfg.com/#sle.
      b. Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. Assembly: ASSE 1019 or ASSE 1052.
   3. Hydrant: Freeze-resistant, self-draining, wall-mounted.
      a. Valve: Bronze or brass body.

b. Hose Connection: Threaded, with integral vacuum breaker or backflow preventer.
c. Hose Connection Size: 3/4 inch (19 mm).
d. Installation: Recessed lockable box.
e. Exterior Finish: Stainless steel.
f. Operation: Loose key.

4. Maximum Working Pressure: 125 psi (8.6 bar).
5. Working Temperature Range: 33 to 120 degrees F (0.5 to 50 degrees C).

B. Roof Hydrants:
1. Manufacturers:
a. Woodford Manufacturing Company: www.woodfordmfg.com/#sle.
b. Zurn Water, LLC: www.zurn.com/#sle.
c. Or approved equal.
2. Hydrant: Freeze-resistant, self-draining, with post-mounted epoxy-coated cast-iron head and lift handle.
a. Roof Interface: Cast-iron roof support sleeve and mounting plate with anchor flange and clamping collar.
b. Valve: Bronze or brass valve, installed below roof line, connected to hydrant head via operating rod.
c. Post: Galvanized-steel pipe. Post acts as casing for water carrier pipe and operating rod.
d. Hose Connection: Threaded. Provide field-installed vacuum breaker or backflow preventer.
e. Hose Connection Size: 3/4 inch (19 mm).
f. Operation: Cast-iron lift handle, lockable.
3. Maximum Working Pressure: 125 psi (8.6 bar).
4. Working Temperature Range: 33 to 120 degrees F (0.5 to 50 degrees C).

2.08 DRAIN VALVES

A. Manufacturers:
1. Jones Stephens: www.jonesstephens.com/#sle.
2. Mueller Streamline, Co: www.muellerstreamline.com/#sle.

B. Ball-Valve Hose-End Drain Valves:
1. Valve: Two-piece, full-port ball valve in brass or bronze with capped hose-end connection.
2. Pressure Rating: 250 psi (17.2 bar).
3. Working Temperature Range: 33 to 140 degrees F (0.5 to 60 degrees C).

2.09 WATER-HAMMER ARRESTORS

A. Manufacturers:
1. Sioux Chief: https://www.siouxchief.com/#sle.
2. Zurn Water, LLC: www.zurn.com/#sle.

B. Piston Type:
1. Description: ASSE 1010 or PDI-WH 201, copper body with plastic piston and EPDM O-rings.
2. Air Preload Pressure: 60 psi (410 kPa).
3. Maximum Working Pressure: 150 psi (10.3 bar).
4. Working Temperature Range: 33 to 180 degrees F (0.5 to 82 degrees C).

2.10 TRAP PRIMERS

A. Water-Supplied Trap Primers:
1. Description: ASSE 1018, bronze or brass body, water-supplied, pressure-drop activated trap primer with internal filter screen and integral vacuum breaker.
2. Operating Pressure Range: 20 to 80 psi (140 to 550 kPa).

3. Activation Pressure Drop: 3 psi (20 kPa).
4. Accessories:
   a. Shutoff valve on inlet.
   b. Manufacturer's distribution unit with four outlet ports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard packing materials and verify product interiors are free from debris, damage, and corrosion.

B. Verify end connections, flanges, threads, and grooves are completely clean without signs of damage or degradation that could result in leakage.

C. For products containing isolation or shutoff valves, verify isolation and shutoff valves operate smoothly from fully closed to fully open.

3.02 INSTALLATION

A. Prior to installation of domestic water piping specialties, flush domestic water piping of foreign material.

B. Install products in accordance with manufacturer's instructions.

C. Install products level and plumb.

D. Install products with clearance for access and maintenance.

E. Support products NPS 2-1/2 (DN 65) and larger independently of surrounding pipe.

F. Support products with flanged or grooved ends independently of surrounding pipe.

G. For products containing isolation or shutoff valves, locate valves in horizontal piping with stems at or above center of piping, maintaining unimpeded stem movement.

H. Backflow Preventers:
   1. Install backflow preventers in accordance with requirements of local authorities having jurisdiction, including requirements of local water utility.
   2. Pipe relief from reduced-pressure-principle backflow preventers to nearest drain.

I. Water Pressure Reducing Valves:
   1. Install shutoff valves on inlet and outlet.
   2. Install pressure gauges on inlet and outlet.

J. Water Hammer Arrestors: Install in accordance with PDI-WH 201.

K. Trap Primers:
   1. Install trap primers minimum of 12 inches (205 mm) above flood level of highest drain being served.
   2. Check that water flows through piping and that there are no leaks before pouring slabs or closing in walls.
   3. Cap unused ports on distribution manifold.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged products.

D. Replace defective products.

E. For products containing isolation or shutoff valves, exercise isolation and shutoff valves from fully closed to fully open. Confirm smooth operation.

F. Backflow Preventers:
   1. Test in accordance with manufacturer's instructions.
   2. Test in accordance with requirements of authorities having jurisdiction.

3. Test in accordance with ASSE listing of backflow preventer.
4. Replace backflow preventers that fail testing.

G. Vacuum Breakers:
1. Test in accordance with manufacturer's instructions.
2. Test in accordance with requirements of authorities having jurisdiction.
3. Test in accordance with ASSE listing of vacuum breaker.
4. Replace vacuum breakers that fail testing.

H. Water Pressure Reducing Valves: Confirm outlet pressure remains steady without fluctuation.

I. Mixing Valves: Confirm outlet temperature remains steady without fluctuation.

J. Coordination of Other Tests and Inspections: Provide access to accommodate tests and inspections by independent testing agencies employed by Owner.

3.04 ADJUSTING

A. Adjust pressure reducing valves to design pressure set point.

B. Adjust mixing valves to design temperature set point.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean products to remove dirt, paint, and other foreign materials.

C. Clean surfaces of products exposed to view in finished spaces to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

D. Clean surfaces of products exposed to view on building exterior to remove dirt, fingerprints, paint, and other foreign materials. Restore finishes to match original factory finish.

E. Clean strainers, including those internal to other products, prior to Date of Substantial Completion.

3.06 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for additional requirements.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Floor drains.

B. Cleanouts.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor Drains; 2022.

B. ASME A112.36.2 - Cleanouts; 2022.

C. ASSE 1072 - Performance Requirements for Barrier Type Floor Drain Trap Seal Protection Devices; 2025, with Editorial Revision.

D. NSF 14 - Plastics Piping System Components and Related Materials; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Plastic Sanitary Waste Piping Specialties: Provide plastic products that comply with NSF 14.

B. Source Limitations: Furnish drains and sanitary waste piping specialties of same kind by same manufacturer.

2.02 FLOOR DRAINS

A. Cast Iron Floor Drains:
   1. Manufacturers:
      a. MIFAB, Inc: www.mifab.com/#sle.
      b. Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. Assembly: ASME A112.6.3.
   3. Body: Dura-coated cast iron with anchor flange and membrane clamping collar with weepholes.
   4. Strainer: Adjustable, removable, with vandal-proof screws.
      a. Types as scheduled on drawings.
   5. Accessories:
      a. Trap primer plug or trap seal insert.
      b. Wide flange for bonding membrane floors.

2.03 CLEANOUTS

A. Manufacturers:
   1. MIFAB, Inc: www.mifab.com/#sle.
   2. Zurn Water, LLC: www.zurn.com/#sle.

B. Floor Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Dura-coated cast iron.
   3. Closure Plug: PVC or ABS, threaded, gastight and watertight.
   4. Top: Adjustable, with vandal-proof screws.
      a. Shape and Finish:
         1) All Locations, Unless Noted Otherwise: Round; nickel bronze.
         2) Carpet: Round; cover recessed for carpet inlay.
         3) Mechanical, Storage, and Support type spaces: Round; scoriated cast iron.
         4) Tile: Square; nickel bronze.
   5. Accessories:
      a. Clamp ring and flange for floors with waterproofing membrane.

C. Wall Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Tee type; body material to match surrounding pipe.
   3. Plug: Bronze, threaded, gastight.
   4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

2.04 MISCELLANEOUS SANITARY WASTE PIPING SPECIALTIES

A. Floor Drain Trap Seals:
   1. Manufacturers:
      a. MIFAB, Inc; MI-GARD: www.mifab.com/#sle.
      b. Zurn Water, LLC; Z1072: www.zurn.com/#sle.
      c. Or approved equal.
   2. Assembly: ASSE 1072.
   3. Description: Push-fit EPDM or silicone fitting with one-way-flow membrane or flapper.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars and bonding flanges.

C. Install drains so strainers and grates are level and are at design elevation.

D. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

E. Install floor cleanouts to allow for floor finishes.

F. Locate, provide, and install cleanouts in piping in accordance with adopted code.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean debris from drains.

C. Clean grates and strainers prior to Date of Substantial Completion.

3.04 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof and exterior surface drains.

B. Downspout adaptors, boots, and nozzles.

C. Cleanouts.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

B. ASME A112.36.2 - Cleanouts; 2022.

C. NSF 14 - Plastics Piping System Components and Related Materials; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on fabrication materials, assembly of components, dimensions, ratings, finishes, rough-in requirements, and installed accessories.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products under cover and protected from weather and dirt. Elevate above grade.

E. Store plastic products protected from direct sunlight.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Plastic Storm Drainage Piping Specialties: Provide plastic products complying with NSF 14.

B. Source Limitations: Furnish drains and storm drainage piping specialties of same kind by same manufacturer.

2.02 ROOF AND EXTERIOR SURFACE DRAINS

A. Cast Iron Roof Drains and Overflow Roof Drains:
   1. Manufacturers:
      a. MIFAB, Inc: www.mifab.com/#sle.
      b. Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. Assembly: ASME A112.6.4.
   3. Body: Dura-coated cast iron with membrane clamping ring with gravel stop.
   4. Strainer: Removable cast iron dome with vandal-proof screws.
   5. Overflow Drains: Provide 3-inch (75 mm) high external overflow waterdam or internal standpipe extension.
   6. Accessories:
      a. Adjustable, extendable collar.
      b. Roof sump receiver.
      c. Under-deck clamp.

2.03 DOWNSPOUT ADAPTERS, BOOTS, AND NOZZLES

A. Downspout Nozzles, Metal:
   1. Manufacturers:
      a. MIFAB, Inc: www.mifab.com/#sle.
      b. Zurn Water, LLC: www.zurn.com/#sle.
      c. Or approved equal.
   2. Description: Cast nickel bronze wall-mounted fitting for terminating interior rainwater leader on building exterior, with anchor flange and decorative cow's tongue outlet.
      a. Provide with stainless steel bird screen.

2.04 CLEANOUTS

A. Manufacturers:
   1. MIFAB, Inc: www.mifab.com/#sle.
   2. Zurn Water, LLC: www.zurn.com/#sle.
   3. Or approved equal.

B. Wall Cleanouts:
   1. Assembly: ASME A112.36.2.
   2. Body: Tee type; body material to match surrounding pipe.
   3. Plug: Bronze, threaded, gastight.
   4. Access Cover: Round, stainless steel wall access cover with vandal-proof screw.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Maintain continuity of waterproofing membranes. Secure waterproofing membranes to drain clamping collars.

C. Install roof drains at low points of roof areas.

D. Extend cleanouts to finished floor or wall surface. Ensure clearance at cleanout for rodding or jetting of drainage system.

E. Locate, provide, and install cleanouts in piping in accordance with adopted code.

3.03 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean debris from drains.

C. Clean grates and strainers prior to Date of Substantial Completion.

3.04 PROTECTION

A. Protect installed drains from accumulating dirt and debris through remainder of construction.

B. Protect installed products from damage due to subsequent construction operations.

END OF SECTION

SECTION 221623 - 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 099113 - Exterior Painting.

B. Section 099123 - Interior Painting.

C. Section 312316 - Excavation.

D. Section 312323 - Fill.

E. Section 335216 - Gas Hydrocarbon Piping.

1.03 REFERENCE STANDARDS

A. ANSI LC 4/CSA 6.32 - Press-Connect Metallic Fittings and Valves for Use in Fuel Gas Distribution Systems; 2022.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019 (Reaffirmed 2024).

C. ANSI Z223.1 - National Fuel Gas Code; 2024.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

E. ASME B31.1 - Power Piping; 2024.

F. ASME B31.9 - Building Services Piping; 2025.

G. 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, with Errata.

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2026.

K. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

L. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

M. IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. ICC (IFGC) - International Fuel Gas Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, 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. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

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. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

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 NATURAL GAS PIPING, BURIED WITHIN 5 FEET (1500 MM) OF BUILDING

A. Steel Pipe: ASTM A53/A53M, Grade B, Type E, 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 (0.25 mm) polyethylene tape.

2.02 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Grade B, Type E, 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: ANSI LC 4/CSA 6.32; ICC (IFGC) approved, and IAPMO (UPC) or IAPMO (UMC) approved, with HNBR seals.
      a. Manufacturers:
         1) Mueller Streamline, Co; STL-G: www.muellerstreamline.com/#sle.
         2) NIBCO INC; BenchPressG: www.nibco.com/#sle.
         3) Viega; MegaPressG: www.viega.us/#sle.
         4) Or approved equal.

2.03 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 2 Inches (50 mm) and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 2 Inch (50 mm):
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded ends, gas-resistant isolation barrier, and gaskets rated for natural gas service; or dielectric flange isolation kit.

2.04 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. 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 polypropylene.

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 (150 mm) under pipe to top of roofing.
f. Manufacturers:
    1) PHP Systems/Design: www.phpsd.com/#sle.
    2) Or approved equal.

2.05 BALL VALVES

A. Manufacturers:
    1. Apollo Valves: www.apollovalves.com/#sle.
    2. Effebi: www.effebi.com/#sle.
    3. Milwaukee Valve Company: www.milwaukeevalve.com/#sle.
    4. Mueller Streamline, Co: www.muellerstreamline.com/#sle.
    5. Or approved equal.

B. Construction, 4 Inches (100 mm) and Smaller: MSS SP-110, Class 150, 400 psi (2760 kPa) CWP, ASME B16.44 and CSA 3.16 approved for fuel gas service; brass or bronze body, 304 stainless steel or chrome-plated brass ball, full port, Teflon seats and stuffing box ring, blowout-proof stem, lever handle, threaded or press ends.

2.06 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Manufacturers:
    1. Maxitrol Company: www.maxitrol.com/#sle.
    2. Or approved equal.

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: 5 psi (34.5 kPa).
    1. Line Pressure Regulator: 10 psi (68.9 kPa).

E. Maximum Body Pressure: 10 psi (1000 mbar).

F. Output Pressure Range: 1 inch wc (2.5 mbar) to 80 inch wc (200 mbar).

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 maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

G. Provide support for utility meters in accordance with requirements of utility companies.

H. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior piping systems and components is specified in Section 099123.
   2. Painting of exterior piping systems and components is specified in Section 099113.

I. Excavate in accordance with Section 312316.

J. Backfill in accordance with Section 312323.

K. Install valves with stems upright or horizontal, not inverted.

L. Sleeve pipes passing through partitions, walls and floors.

M. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Use hangers with 1-1/2 inch (40 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
      a. Painting of interior piping systems and components is specified in Section 099123.
      b. Painting of exterior piping systems and components is specified in Section 099113.

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.

3.05 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with gas utility company requirements. Gas service distribution piping to have initial minimum pressure of 2 psi (14 kPa). Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.06 SCHEDULES

A. Pipe Hanger Spacing:
   1. Steel Piping:
      a. Pipe Size: 1/2 inches (15 mm):
         1) Maximum Hanger Spacing: 6 ft (1.8 m).
         2) Hanger Rod Diameter: 3/8 inches (9 mm).
      b. Pipe Size: 3/4 inches (18 mm) to 1 inches (25 mm):
         1) Maximum Hanger Spacing: 8 ft (2.4 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).
      c. Pipe Size: 1-1/4 inches (32 mm) to 2 inches (50 mm):
         1) Maximum Hanger Spacing: 10 ft (3 m).
         2) Hanger Rod Diameter: 3/8 inch (9 mm).

END OF SECTION

SECTION 223000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tankless gas-fired water heaters.

B. Commercial electric water heaters.

C. Diaphragm-type compression tanks.

D. In-line circulator pumps.

1.02 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. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2024, with Errata (2026).

E. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data:
   1. Product Data: Provide manufacturer's literature and data sheets for each product. Include information on materials of fabrication, assembly of components, dimensions, weights, capabilities, performance, electrical characteristics, location and sizes of connections, service and access locations, and manufacturer-provided and field-installed accessories.

C. Manufacturer's qualification statement.

D. 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 the type of products specified in this section, with minimum three years of documented experience.

B. Certifications:
   1. Water Heaters: NSF approved.
   2. Gas Water Heaters: ANSI Z21.10.1 and ANSI Z21.10.3.
   3. Electric Water Heaters: UL listed and labeled to UL 174.
   4. 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. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for domestic water heaters. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:
   1. A.O. Smith Water Products Co: www.hotwater.com/#sle.
   2. Lochinvar: www.lochinvar.com/#sle.
   3. Navien: www.navieninc.com/#sle.
   4. Or approved equal..

B. Tankless Gas-Fired Water Heaters:
   1. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   2. Water Inlet Pressure: From 30 psi (207 kPa) to 150 psi (1034 kPa).
   3. Supply Gas Type: Natural gas.
   4. Minimum Thermal Input: 199,000 Btu/h (58.3 kWh) at sea level.
   5. Capcity: 5.7 gpm at 65 degree F (21.6 L/min at 18.3 degree C) rise.
   6. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, air intake valve, condensate solenoid drain valve, water-inlet strainer, removable thermally-insulated front panel, blower access cover, and threaded water, gas, and condensate pipe-end connections.
   7. Burner-Heat Exchanger: 316L stainless steel assembly with single flue passage, flue baffle, and draft hood; thermally insulated and encased in corrosion-resistant steel jacket; baked-on enamel finish.
   8. Safeties: Provide internal safeties for vent side, water flow, flame detection, fan speed, electrical load, and thermal load.
   9. Controls: Local temperature display with setpoint dial interface for internal controls and built-in gas pressure regulator; temperature range adjustable from 100 to 185 degrees F (37.7 to 85 degrees C) using hot surface ignition and power venter.
   10. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet MS/TP.
   11. Accessories: Provide cold water inlet expansion tank, inlet ball valve, outlet ball valve, outlet ASME-ratred temperature-pressure relief valve, pipe-mounted thermometers, and condensate neutralization kit.
   12. Electrical Load: 120 VAC, single phase.

C. Commercial Electric Water Heaters:
   1. Type: Factory-assembled and wired, electric, vertical storage.
   2. Minimum Efficiency Required: ASHRAE Std 90.1 I-P.
   3. Performance: As scheduled on drawings.
   4. Electrical Characteristics: As scheduled on drawings.
   5. Tank: Glass lined welded steel; thermally insulated with minimum 2 inches (50 mm) glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
   6. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.
   7. Accessories:
      a. Water Connections: Brass.
      b. Dip Tube: Brass.
      c. Drain valve.
      d. Anode: Magnesium.
      e. Temperature and Pressure Relief Valve: ASME labeled.
   8. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in (11.6 W/sq m).

2.02 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Manufacturers:
   1. Amtrol Inc: www.amtrol.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Watts: www.watts.com/#sle.
   4. Or approved equal.

B. Construction: Non-ASME welded steel outer shell with a corrosion-resistant interior lining suitable for potable water, rated for a minimum working pressure of 150 psig (1034 kPa); equipped with a fixed butyl diaphragm/bladder separating air and water; NSF/ANSI/CAN 61 certified and IAPMO listed.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge air pressure to match domestic water static pressure prior to installation.

2.03 IN-LINE CIRCULATOR PUMPS

A. Manufacturers:
   1. Armstrong Fluid Technology: www.armstrongfluidtechnology.com/#sle.
   2. Bell & Gossett, a brand of Xylem, Inc: www.bellgossett.com/#sle.
   3. Or approved equal.

B. The pumps shall be of the horizontal system lubricated type specifically designed and guaranteed for quiet operation.

C. Pump to be suitable for 230 degree F (110 degree C) operation at 150 psig (10.3 Bar) working pressure.

D. The pumps shall have a ceramic shaft supported by carbon bearings. Bearings are to be lubricated by the circulating fluid.

E. Pump body shall be lead-free bronze for NBF circulators or stainless steel for SSF circulators.

F. Motor stator to be isolated from circulating fluid through use of stainless steel can. Rotor to be sheathed in stainless steel.

G. Motors shall be non-overloading at any point on the pump curve. NBF-36 & NBF-45 to have built-in thermal protection. All other motors to have built-in impedance protection.

H. Performance: As scheduled on drawings.

I. Electrical Characteristics: As scheduled on drawings.

J. Accessories:
   1. Aquastat and time clock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions required for applicable certifications.

B. Electrical Work: Provide automatic control and protective devices with associated wiring to interconnect related interfaced devices required for specified operation.

C. Coordinate system, equipment, and piping work with applicable electrical, gas, vent, drain, and waste support interconnections as included or provided by other trades.

D. Pumps:
   1. Provide line sized isolating valve 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.

SECTION 224000 - PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush valve water closets.

B. Wall hung urinals.

C. Lavatories.

D. Under-lavatory pipe supply covers.

E. Indoor drinking fountains.

F. Mop sinks.

1.02 RELATED REQUIREMENTS

A. Section 221119 - Domestic Water Piping Specialties.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2008 (Reaffirmed 2013).

C. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

E. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

F. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2024.

G. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2022.

H. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2022.

I. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

N. NSF 42 - Drinking Water Treatment Units – Aesthetic Effects; 2023.

O. NSF 53 - Drinking Water Treatment Units – Health Effects; 2025.

P. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

Q. NSF 372 - Drinking Water System Components - Lead Content; 2024.

R. NSF 401 - Drinking Water Treatment Units – Emerging Compounds / Incidental Contaminants; 2023.

S. UL (DIR) - Online Certifications Directory; Current Edition.

T. UL 399 - Drinking Water Coolers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, utility sizes, trim, and finishes.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

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 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.

1.07 WARRANTY

A. See Section 017800 - 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 drinking water system components certified as complying with NSF 61 and NSF 372.

B. ADA: Where indicated to be ADA-compliant, provide fixtures complying with ADA Standards and ICC A117.1.

C. Maximum Fixture Supply Pressure: 80 psi (550 kPa) unless stated otherwise.

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 FLUSH VALVE WATER CLOSETS

A. As scheduled on drawings.

B. Water Closets:
   1. Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps.
   2. Bowl: ASME A112.19.2; 15 and 16-1/2 inch high with elongated rim.
   3. Flush Valve: Exposed (top spud).
   4. Flush Operation: Sensor operated.
   5. Handle Height: 44 inches (1117 mm) or less.
   6. Inlet Size: 1-1/2 inches (38 mm).
   7. Trapway Outlet: 4 inch (100 mm, DN).
   8. Color: White.
   9. Manufacturers:
      a. American Standard: www.americanstandard-us.com/#sle
      b. Kohler Company: www.kohler.com/#sle.
      c. Zurn Industries, LLC: www.zurn.com/#sle.
      d. Or approved equal.

C. Flush Valves:
   1. Valve Supply Size: 1 inch (25 mm, DN).
   2. Valve Outlet Size: 1-1/2 inches (40 mm, DN).
   3. Manufacturers:
      a. Sloan Valve Company: www.sloanvalve.com/#sle.

b. Toto USA: www.totousa.com/#sle.
c. Zurn Industries, LLC: www.zurn.com/#sle.
d. Or approved equal.

4. Sensor-Operated:
   a. Type: ASME A112.19.5; chloramine-resistant diaphragm valve complete with vacuum breaker, stops and accessories.
   b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with battery powered infrared sensor, and mechanical override or override push button.
   c. Supplied Volume Capacity: 1.6 gal (6.1 L) per flush.
5. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

D. Toilet Seats:
1. Manufacturers:
   a. American Standard: www.americanstandard-us.com/#sle
   b. Bemis Manufacturing Company: www.bemismfg.com/#sle.
   c. Church Seat Company: www.churchseats.com/#sle.
   d. Zurn Industries, LLC: www.zurn.com/#sle.
   e. Or approved equal.
2. Plastic: White finish, elongated shape, open front, extended back, self-sustaining hinge, brass bolts, without cover.

2.04 WALL HUNG URINALS

A. Manufacturers:
1. American Standard: www.americanstandard-us.com/#sle
2. Kohler Company: www.kohler.com/#sle.
3. Zurn Water, LLC: www.zurn.com/#sle.
4. Or approved equal.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Consumption Volume: 1.0 gal (3.7 L) per flush, maximum.
2. Flush Style: Washout.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trapway Outlet: Integral.
6. Removable stainless steel strainer.
7. Supply Size: 3/4 inch (19 mm).
8. Outlet Size and Location: 2 inches (50 mm), rear side.

C. Flush Valves:
1. Manufacturers:
   a. Sloan Valve Company: www.sloanvalve.com/#sle.
   b. Toto USA: www.totousa.com/#sle.
   c. Zurn Water, LLC: www.zurn.com/#sle.
   d. Or approved equal.
2. Sensor-Operated:
   a. Type: ASME A112.19.5; chloramine-resistant, diaphragm valve with vacuum breaker, stops and accessories.
   b. Mechanism: Solenoid-operated piston or electronic motor-actuated operator with battery powered infrared sensor, and mechanical override or override push button.
   c. Supplied Volume Capacity: 1.0 gal (3.8 L) per flush.
3. Exposed Type: Chrome-plated, escutcheon, integral screwdriver stop.

D. Urinal Carriers:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   b. JOSAM Company: www.josam.com/#sle.

c. Zurn Water, LLC: www.zurn.com/#sle.
d. Or approved equal.

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.

2.05 LAVATORIES

A. Manufacturers:
1. Kohler Company: www.kohler.com/#sle.
2. Zurn Industries, LLC: www.zurn.com/#sle.
3. American Standard.
4. Or approved equal.

B. As scheduled on drawings.

C. Wall-Mount Bathroom Sink:
1. Vitreous China: ASME A112.19.2; white, oval basin with front overflow and shroud. Size as indicated on drawings with single faucet hole.
2. Carrier:
a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, concealed arm supports, bearing plate and studs.
b. Manufacturers:
1) Jay R. Smith MFG. Co: www.jrsmith.com/#sle.
2) JOSAM Company: www.josam.com/#sle.
3) Zurn Water, LLC: www.zurn.com/#sle.
4) Or approved equal.

D. Supply Faucet:
1. Deck Mounted Faucet Manufacturers:
a. American Standard: www.americanstandard-us.com/#sle
b. Kohler Company: www.kohler.com/#sle.
c. Zurn Water, LLC; Aqua Sense Series: www.zurn.com/#sle.
d. Or approved equal.
2. Single-Lever Handle, Supply Faucet: ASME A112.18.1; deck-mount, ceramic cartridge disc valve, open grid strainer, and maximum flow of 0.5 gpm, low-flow (1.9 L/min, low-flow).

E. Thermostatic Mixing Valve:
1. ASSE 1070 water temperature limiting valve.
2. See Section 221119 for mixing valve specifications.

F. Accessories:
1. Offset waste with perforated open strainer.
2. Chrome-plated 17 gauge, 0.0538 inch (1.37 mm) brass P-trap with clean-out plug, tailpiece, and escutcheon.
3. Screwdriver stops.
4. Flexible supplies.

2.06 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc: www.plumberex.com/#sle.
2. Truebro: www.ipsplumbingproducts.com/brands/truebro/#sle..
3. Or approved equal.

B. 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 (3.2 mm) 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 E84 for flame and smoke development.
    c. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
    d. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
    e. Comply with ICC A117.1.
    f. 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.

2.07 INDOOR DRINKING FOUNTAINS

A. Manufacturers:
    1. Elkay Manufacturing Company: www.elkay.com/#sle.
    2. Halsey Taylor: www.halseytaylor.com/#sle.
    3. Haws Corporation: www.hawsco.com/#sle.
    4. Or approved equal.

B. On-Wall Bottle Filling Stations with Bi-Level Water Coolers and Filtration:
    1. Assembly: UL 399, ASME A112.19.3.
    2. Water Cooler Configuration: Bi-level.
        a. For bi-level coolers, provide standard left-high, right-low configuration.
    3. Water Coolers:
        a. Chassis: Galvanized steel.
        b. Stainless steel finish.
        c. Basin: Stainless steel, sloped to capture spillage from bubbler and contoured to include level bottle rest for bottle filler.
        d. Bubbler: Flexi-Guard safety bubbler.
        e. Operation: Side and front push bars.
    4. Bottle Filler:
        a. Construction: Stainless steel with factory-applied powder coating in color to match water cooler.
        b. Lighting: LED-lighted alcove.
        c. Operation: Sensor.
        d. Flow: 1.1 gpm (4.2 L/min) laminar flow.
        e. Drain: Dedicated bottle filler drain.
    5. Features:
        a. Antimicrobial coating.
        b. Top-mounted quick-change water filters.
        c. Filter status lights.
        d. Automatic Filter Recognition: System automatically detects new filters, flushes system, and resets filter status lights.
        e. Plastic-bottles-saved counter.
    6. Filters:
        a. Provide filters certified as complying with NSF 42, NSF 53, and NSF 401.
        b. Provide manufacturer's standard filter to reduce lead, microplastics, Class 1 particulates, chlorine taste, and odors with 10,000-gallon (37850 L) filter life. Provide single filter.
    7. Cooling System: Hermetically sealed, reciprocating compressor, fan-cooled condenser, tube-on-tank evaporator, R-134a refrigerant. Provide adjustable aquastat.

8. Cooling Capacity: 8 gph (30.3 L/hr) of 50-degree F (10 degree C) water with inlet at 80 degrees F (27 degrees C) and room temperature of 90 degrees F (32 degrees C), when tested in accordance with ASHRAE Std 18.
9. Electrical: 5 FLA, 115 VAC, 60 Hz, with cord and plug.

2.08 MOP SINKS

A. Manufacturers:
   1. Acorn Engineering Company: www.acorneng.com/#sle.
   2. Fiat Products: www.fiatproducts.com/#sle.
   3. Just Manufacturing Company: www.justmfg.com/#sle.
   4. Metcraft Industries, Inc: metcraftindustries.com/#sle.
   5. Zurn Water, LLC: www.zurn.com/#sle.
   6. Or approved equal.

B. Material: Molded stone.

C. Type: Rectilinear.

D. Grid Strainer: Stainless steel; integral; removable.

E. Dimensions: As indicated on drawings.

F. Faucet: Chrome plated, faucet with vacuum breaker, integral stops, adjustable wall brace, pail hook and 3/4" (19mm) hose thread on spout. 8" (203mm) centerset

G. Accessories:
   1. 5 feet (1.5 m) of 1/2 inch (13 mm) diameter plain end reinforced rubber hose.
   2. Hose clamp hanger.
   3. Mop hanger.
   4. Stainless steel wall guards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify walls, floors, and finishes are prepared and ready for installation of fixtures.

B. Verify rough-ins for field connections match sizes and locations shown on drawings.

C. Verify electric power is available and of the correct characteristics.

D. Review casework and countertop shop drawings. Confirm locations and sizes of fixtures and openings before rough-in and installation.

E. Verify casework and countertops are prepared and ready for installation of fixtures.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install components level and plumb.

C. Secure fixtures in place.

D. Install rigid or flexible supplies to fixtures. Provide supply stops, reducers, and escutcheons.

E. Install wall-mounted fixtures, trim, and accessories at heights indicated on Architectural drawings.

F. Install new batteries in battery-powered fixtures at time of Date of Substantial Completion.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged or defective products.

D. Test fixtures after installation to verify operation. Correct deficiencies.

3.04 ADJUSTING

A. Adjust stops and valves so fixtures operate without splashing, noise, or overflow.

B. Adjust sensor range on sensor-operated fixtures in accordance with manufacturer's instructions to ensure proper detection and operation without false triggering.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean plumbing fixtures to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

END OF SECTION

SECTION 224017 - BATHTUBS AND SHOWERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Showers.

B. Bathtub and shower faucets, valves, and trim.

1.02 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.1 - Plumbing Supply Fittings; 2024.

C. ASME A112.18.2 - Plumbing Waste Fittings; 2020 (Reaffirmed 2025).

D. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2020.

E. ASSE 1016 - Performance Requirements for Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations; 2017 (Reaffirmed 2021).

F. IAPMO Z124 - Plastic Plumbing Fixtures; 2022, with Editorial Revision.

G. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

H. NSF 61 - Drinking Water System Components - Health Effects; 2025, with Addendum

I. NSF 372 - Drinking Water System Components - Lead Content; 2024.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's literature and data sheets for each product. Include materials of fabrication, rough-in requirements, location and sizes of connections, configurations, dimensions, finishes, features, and accessories.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

C. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

D. Store products indoors in clean, dry area. Protect from water and dirt. Elevate above floor.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide supply fixtures, fittings, valves, and trim certified as complying with NSF 61 and NSF 372.

B. ADA: Where indicated to be ADA-compliant, provide fixtures complying with ADA Standards and ICC A117.1.

C. Maximum Fixture and Faucet Supply Pressure: 80 psi (550 kPa) unless stated otherwise.

2.02 SHOWERS

A. Manufacturers:
   1. Accessibility Professionals: www.accessibilitypro.com/#sle.
   2. American Bath Group: www.americanbathgroup.com/#sle.
   3. Best Bath Systems: www.bestbath.com/#sle.
   4. Or approved equal.

B. Acrylic and Fiberglass Showers: IAPMO Z124, molded cast acrylic or reinforced glass fiber with acrylic or gel overlay, with slip-resistant surface.

C. Style:
   1. Single-piece shower.

D. Shower Reinforcing: Factory-installed full plywood backing for grab bar placement.

E. Drains: Provide ASME A112.18.2, NPS 2 (DN 50) drain and p-trap.
   1. Drain Finish: Chrome.

F. ADA Transfer Shower Accessories:
   1. Folding Seat: Factory or field installed to meet ADA Standards and ICC A117.1.
   2. Grab Bars: Manufacturer provided in quantity, size, and locations to meet ADA Standards and ICC A117.1.
   3. Shower rod.

2.03 BATHTUB AND SHOWER FAUCETS, VALVES, AND TRIM

A. Shower Valves and Trim:
   1. Manufacturers:
      a. American Standard: www.americanstandard-us.com/#sle
      b. Kohler Company: www.kohler.com/#sle.
      c. Or approved equal.
   2. Assembly: ASME A112.18.1, with control valve, shower head, and arm.
   3. Control Valve: ASSE 1016, pressure-balancing, brass or bronze body with inlet checkstops; integral volume and temperature control with adjustable high-temperature limit stop.
   4. Finish: Chrome.
   5. Flow Rate: Maximum 1.75 gpm (6.6 L/min) at 80 psi (550 kPa).

B. Hand Showers:
   1. Manufacturers:
      a. American Standard: www.americanstandard-us.com/#sle
      b. Kohler Company: www.kohler.com/#sle.
      c. Or approved equal.
   2. Assembly: ASME A112.18.1 with shower wand, wall supply elbow, hose, and ASSE 1014 backflow preventer.
   3. Control Valve: ASSE 1016, pressure balancing, brass or bronze body with inlet checkstops; integral volume and temperature control with adjustable high-temperature limit stop.
   4. Finish: Chrome.
   5. Hose: Minimum 59-inch (1499 mm) flexible metal hose in finish to match shower wand.
   6. Flow Rate: Maximum 2.5 gpm (9.5 L/min) at 80 psi (550 kPa).
   7. Hand Shower Mounting:
      a. Mounting Bar: Minimum 36-inch (914 mm) long wall bar with adjustable slide.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify walls, floors, and finishes are prepared and ready for installation of fixtures.

B. Verify rough-ins for field connections match sizes and locations shown on drawings.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products level and plumb.

C. Secure fixtures in place.

D. Install wall-mounted fixtures, trim, and accessories at heights indicated on Architectural drawings.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect each product for damage and defects.

C. Repair or replace damaged or defective products.

D. Test fixtures after installation to verify operation. Correct deficiencies.

3.04 ADJUSTING

A. Adjust control valves and integral high-temperature limit stops in accordance with manufacturer's instructions to ensure maximum delivered water temperature does not exceed 120 deg F (49 deg C).

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean fixtures to remove dirt, fingerprints, paint, and other foreign material. Restore finishes to match original factory finish.

3.06 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

END OF SECTION

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

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 A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2024.

G. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures; 1999 (Reapproved 2022).

H. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

I. 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.

J. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

L. FM (AG) - FM Approval Guide; Current Edition.

M. MFMA-4 - Metal Framing Standards Publication; 2004.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

O. UL (DIR) - Online Certifications Directory; Current Edition.

P. 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 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

C. 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.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. 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. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of HVAC work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. 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.
4. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
5. 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. 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. Prefabricated Trapeze-Framed Metal Strut Systems:
1. Manufacturers:
a. ABB Installation Products: electrification.us.abb.com/#sle.
b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
c. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
d. Gripple, Inc: www.gripple.com/#sle.
e. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
f. Or equal.

2. MFMA-4 compliant, pre-fabricated, MSS SP-58 type 59 continuous-slot metal strut channel with associated tracks, fittings, and related accessories.
3. MFMA-4 compliant, prefabricated, side-loading continuous-slot metal strut channel bracket with associated tracks, fittings, and related accessories.
4. Strut Channel or Bracket Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
   b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
6. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 1-5/8 inch (41 mm) height.
7. Accessories: Provide bracket covers, clamps, protectors, and vibration dampeners.

C. Strut Channels:
1. ASTM A653/A653M galvanized steel bracket with clamps for surface mounting of piping or HVAC equipment support.
2. Channel or Bracket Kits: Include rods, brackets, end-fixed fittings, covers, clips, and other related hardware required to complete sectional trapeze section for piping or other support.

D. Channel Nuts:
1. Provide carbon steel channel nut with zinc finish and long, regular, or short spring.

E. Hanger Rods:
1. Threaded zinc-plated steel unless otherwise indicated.
2. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch (13 mm) diameter.
   b. Piping up to 1 inch (25 mm, DN): 3/8 inch (10 mm) diameter.
   c. Piping larger than 1 inch (25 mm, DN): 3/8 inch (10 mm) diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch (10 mm) diameter.

F. Cable Hanging System Kits:
1. Manufacturers:
   a. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
   b. Ductmate Industries, Inc: ductmate.com/#sle.
   c. Gripple, Inc: www.gripple.com/#sle.
   d. Or approved equal.
   e. Source Limitations: Furnish hardware, fittings, and accessories from single manufacturer.
2. Provide cable-wire in bulk or precut lengths with respective cable hangers as required to hold minimum weight of 240 lb (108.8 kg).
3. Accessories: Provide brackets, clip or c-clip hangers, covers, and y-hook hangers.

G. Thermal Insulated Pipe Supports:
1. General 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 to 30 inch (15 to 750 mm, DN) copper tubes.
   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.

H. Pipe Supports:
1. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
2. Liquid Temperatures Up To 122 degrees F (50 degrees C):

a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
b. Support From Below: MSS SP-58 Types 35 through 38.

I. Beam Clamps:
1. MSS SP-58 types 19 through 23, 25 or 27 through 30 based on required load.
2. Beam C-Clamp: MSS SP-58 type 23, malleable iron and steel with stainless steel and zinc finish.
3. Small or Junior Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish. For inverted usage provide manufacturer listed size(s).
4. Wide Mouth Beam Clamp: MSS SP-58 type 19, malleable iron with zinc finish.
5. Centerload Beam Clamp with Extension Piece: MSS SP-58 type 30, malleable iron with zinc finish.
6. FM (AG) and UL (DIR) Approved Beam Clamp: MSS SP-58 type 19, zinc finish,
7. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
8. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.

J. U-Bolts:
1. MSS SP-58 Type 24, zinc-coated carbon steel u-bolt for pipe support or anchoring.

K. Strut Clamps:
1. Pipe Clamp: Two-piece rigid, universal, or outer diameter type, carbon steel with zinc finish.
2. Cushioned Pipe or Tubing Strut Clamp: Provide strut clamp with thermoplastic elastomer cushion having dielectric strength of 670 V/mil (26,398,000 V/m).
3. Service Temperature Range: Minus 65 to 275 degrees F (Minus 53.8 to 135 degrees C).

L. Insulation Clamps:
1. Two bolt-type clamps designed for installation under insulation.
2. Material: Carbon steel with epoxy copper finish.

M. Pipe Hangers:
1. Band Hangers, Adjustable:
a. MSS SP-58 Type 7 or 9, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
2. J-Hangers, Adjustable:
a. MSS SP-58 Type 5, Zinc-plated ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel.
b. Felt-Lining: Provide for uninsulated pipe to reduce noise and prevent static issues.
3. Swivel Ring Hangers, Adjustable:
a. MSS SP-58 Type 10, epoxy-painted, zinc-colored.
b. Material: ASTM A395/A395M ductile iron, ASTM A36/A36M carbon steel, ASTM A47/A47M malleable iron, ASTM A181/A181M forged steel, or ASTM A283/A283M steel.
c. FM (AG) and UL (DIR) listed for specific pipe size runs and loads.
d. Felt-Lining: Provide for uninsulated pipe to reduce noise and prevent static issues.
4. Clevis Hangers, Adjustable:
a. Copper Tube: MSS SP-58 Type 1, epoxy-plated copper.
b. Felt-Lined: MSS SP-58 Type 1, zinc-plated, silicone-free carbon steel.
c. Light-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.
d. Standard-Duty: MSS SP-58 Type 1, zinc-colored, epoxy plated.

N. 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.

O. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:
   a. Anvil International: www.anvilintl.com/#sle.
   b. B-Line, a brand of Eaton Corporation: www.eaton.com/#sle.
   c. Green Link, Inc: www.greenlinkengineering.com/#sle.
   d. PHP Systems/Design: www.phpsd.com/#sle.
   e. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   f. Or approved equal.
2. Provide steel pedestals with thermoplastic or rubber base 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.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.

P. Pipe Shields for Insulated Piping:
1. MSS SP-58 Type 40, ASTM A1011/A1011M steel or ASTM A653/A653M carbon steel
2. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: galvanized steel.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch (321 mm).
   d. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).
   e. Maximum Service Temperature: 178 degrees F (81 degrees C).
   f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

Q. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the 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-ceiling clamps, beam clamps, machine bolts, or welded threaded studs.
7. Beam Ceiling Flanges: ASTM A47/A47M Grade 32510, malleable iron or stainless steel with copper, stainless steel, or zinc finish.
8. Sheet Metal: Use sheet metal 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.

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. 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. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. 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.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Pipe markers.

E. 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. See Section 013000 - 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.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Control Panels: Nameplates.

C. Dampers: Ceiling tacks, where located above lay-in ceiling.

D. Ductwork: Pressure-sensitive adhesive labels.

E. Major Control Components: Nameplates.

F. Piping: Pipe markers.

G. Relays: Tags.

H. Small-sized Equipment: Tags.

I. Thermostats: Nameplates.

J. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch (6 mm).

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch (0.76 mm); printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Green/White.

D. Size: Minimum 2-inch (50 mm) high lettering on 2-1/2-inch (65 mm) high marker background.

2.05 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.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

B. Color code as follows:
   1. HVAC Equipment: Yellow.
   2. Heating/Cooling Valves: Blue.

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 pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch (20 mm) 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 (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Install ductwork with Pressure-sensitive adhesive labels. Identify with air handling unit identification number and area served. Locate identification at air handling unit, 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.

END OF SECTION

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of refrigerating systems.

1.02 RELATED REQUIREMENTS

A. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.

1.03 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. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. 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. Submit to Engineer.
   2. Submit to the Owner's Representative.
   3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   4. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Engineer and other installers to sufficiently understand the design intent for each system.
   5. 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. Identification and types of measurement instruments to be used and their most recent calibration date.
      d. Discussion of what notations and markings will be made on the duct drawings during the process.
      e. Final test report forms to be used.
      f. Detailed step-by-step procedures for TAB work for each system and issue, including:
         1) Terminal flow calibration (for each terminal type).
         2) Diffuser proportioning.
         3) Branch/submain proportioning.
         4) Total flow calculations.
         5) Rechecking.
      g. Expected problems and solutions, etc.
      h. Details of how TOTAL flow will be determined; for example:
         1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
      i. Specific procedures that will ensure that air side is operating at the lowest possible pressures and methods to verify this.

j. Confirmation of understanding of the outside air ventilation criteria under all conditions.
k. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
l. Method of checking building static and exhaust fan and/or relief damper capacity.
m. Time schedule for deferred or seasonal TAB work, if specified.
n. False loading of systems to complete TAB work, if specified.
o. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
p. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
q. Procedures for formal progress reports, including scope and frequency.
r. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to the Owner's Representative.

E. 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.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
1. Submit under provisions of Section 014000.
2. Submit to the Owner's Representative within two weeks after completion of testing, adjusting, and balancing.
3. Revise TAB plan to reflect actual procedures and submit as part of final report.
4. 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.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
a. Name of Testing, Adjusting, and Balancing Agency.
b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Project name.
e. Project location.
f. Project Architect.
g. Project Engineer.
h. Project Contractor.
i. Project altitude.
j. Report date.

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. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
   1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
   2. Having minimum of three years documented experience.
   3. Certified by one of the following:
      a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
      b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
      c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

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. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.

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. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Owner's Representative to facilitate spot checks during testing.

C. 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. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner's Representative.

H. 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. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take airflow measurements and balance systems under extreme operating conditions, including full cooling, full heating, and 100 percent outdoor air economizer modes.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

3.07 SCOPE

A. Test, adjust, and balance the following:
   1. Air Cooled Refrigerant Condensers.
   2. Packaged Roof Top Heating/Cooling Units.
   3. Fans.
   4. Air Inlets and Outlets.

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.

B. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

C. 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.

D. Heating Coils:
1. Identification/number.
2. Service.
3. Manufacturer.
4. Air flow, design and actual.
5. Entering air temperature, design and actual.
6. Leaving air temperature, design and actual.
7. Air pressure drop, design and actual.

E. 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. Fan RPM.

F. 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.

G. 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. Fan RPM.

H. 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.

I. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

SECTION 230713 - DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Jacketing and accessories.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2024.

B. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2025.

C. ASTM C1423 - Standard Guide for Selecting Jacketing Materials for Thermal Insulation; 2021.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

F. SAE AMS3779 - Tape, Adhesive, Pressure-Sensitive Thermal Radiation Resistant, Aluminum Coated Glass Cloth; 2016b.

G. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors; Current Edition, Including All Revisions.

H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of 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 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.
   5. Or approved equal.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. K (Ksi) value: 0.27 at 75 degrees F (0.039 at 24 degrees C).
   2. Maximum Service Temperature: 250 degrees F (121 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure-sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure-sensitive rubber-based adhesive.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. CertainTeed Corporation: www.certainteed.com/#sle.
   2. Johns Manville: www.jm.com/#sle.
   3. Knauf Insulation: www.knaufinsulation.com/#sle.
   4. Owens Corning Corporation: www.owenscorning.com/en-us/#sle.
   5. Or approved equal.

B. Insulation: ASTM C612; rigid, noncombustible.
   1. K (Ksi) Value: 0.24 at 75 degrees F (0.036 at 24 degrees C).
   2. Maximum Service Temperature: 450 degrees F (232 degrees C).
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 3.0 pcf (48 kg/cu m).

2.04 JACKETING AND ACCESSORIES

A. Reinforced Tape:
   1. FSK tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
   2. Comply with UL 723 or ASTM E84.
   3. Moisture Vapor Permeability: 0.00 perm inch (0.00 ng/(Pa s m)), when tested in accordance with ASTM E96/E96M.
   4. Finish: Match insulation.

B. UL181 Tape for Flexible Ductwork:
   1. Comply with UL 181B for flexible ductwork.
   2. Aluminum foil coated with pressure-sensitive adhesive on paper release liner.
   3. Foil tape suitable for sealing seams between insulation, insulated elbows, and fittings resulting in a tight, smooth surface without wrinkles.
   4. Finish: Printed with UL Listing for identification.

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. Insulated Ducts Conveying Air Below Ambient Temperature:
   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.

C. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

D. Slope exterior ductwork to shed water.

3.03 SCHEDULES

A. Exhaust Ducts Within 10 ft (3 m) of Exterior Openings: Glass fiber ductwrap with minimum R-value of 6.

B. Externally insulated ductwork: Glass fiber ductwrap with minimum R-value of 6.

C. Interior double-wall duct: Glass fiber blanket interstitial insulation, 1 inch thick.

D. Double-wall ducts exposed to outdoors: Glass fiber blanket interstitial insulation with minimum R-value of 8.

END OF SECTION

SECTION 230719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jacketing and accessories.

C. Engineered wall outlet seals and refrigerant piping insulation protection.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2026.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

G. 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; 2026.

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

I. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

K. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three 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 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us/#sle.
   3. K-Flex USA LLC: www.kflexusa.com/#sle.
   4. Or approved equal.

B. 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 (Minus 40 degrees C).
   2. Maximum Service Temperature: 180 degrees F (82 degrees C).
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 JACKETING AND ACCESSORIES

A. Aluminum Jacket:
   1. Comply with ASTM B209/B209M, Temper H14, minimum thickness of 0.016 inch (0.41 mm) with factory-applied polyethylene and kraft paper moisture barrier on the inside surface.
   2. Thickness: 0.016 inch (0.40 mm) sheet.
   3. Type: Field-applied roll jacket or Field-formed.
   4. Finish: Embossed.
   5. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   6. Fittings: 0.016 inch (0.40 mm) thick die-shaped fitting covers with factory-attached protective liner.
   7. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

2.04 ENGINEERED WALL OUTLET SEALS AND REFRIGERANT PIPING INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
   1. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
   2. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.

B. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
   1. Wall Outlet Size, Siding and Compact Applications: 6-7/8 inch wide by 3-7/8 inch high (175 mm wide by 99 mm high).
      a. Elastomeric Sleeve Diameter: 1-11/16 inch (43 mm).
   2. Outlet Cover Color: To be selected by Architect.
   3. Water Penetration: Comply with ASTM E331.
   4. Air Leakage: Comply with ASTM E283/E283M.
   5. Air Permeance: Comply with ASTM E2178.

C. Insulation Protection System: Refrigerant piping insulation PVC protective 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.

4. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
5. Flame Spread and Smoke Development Rating of 24/450: Comply with ASTM E84 or UL 723.
6. Carbon Arc Light Exposure: Comply with ASTM G153.
7. Tensile Strength After UV Exposure and Water Immersion: Comply with ASTM D412.
8. Water Absorption of Plastics: Comply with ASTM D570.
9. Adhesive free.

2.05 ACCESSORIES

A. General Requirements:
   1. Provide required accessories in accordance with and subject to the recommendations of the insulation manufacturer.
   2. Furnish compatible materials which do not contribute to corrosion, soften, or otherwise attack surfaces to which applied, in either the wet or dry state.
   3. Supply materials that are asbestos free.

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. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

D. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, see Section 078400.

3.03 SCHEDULE

A. Cooling Systems:
   1. Cold Condensate Drains (Interior to the building): Elastomeric, 1/2 inch thick.
   2. Refrigerant Suction: Elastomeric, 3/4 inch thick.
   3. Refrigerant Liquid: Elastomeric, 1/2 inch thick.

END OF SECTION

SECTION 230923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Controllers.

C. Power supplies and line filtering.

1.02 RELATED REQUIREMENTS

A. Section 230993 - Sequence of Operations for HVAC Controls.

B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h, with Editorial Revision (2022).

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

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. 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. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 CONTROL SYSTEM CONTRACTOR AND BAS EXTENSION

A. Designated Controls Contractor: Building Automation System (BAS) extension, BACnet equipment integration, low-voltage control wiring, and field commissioning specified in this section shall be performed by Powers of Arkansas as a designated subcontractor under the Mechanical Contractor scope of work.

B. Mechanical Contractor Scope: Mechanical Contractor shall engage Powers of Arkansas and include in their bid all labor, materials, BACnet communication gateways, low-voltage cabling, programming, graphics updates, and commissioning required to integrate new HVAC equipment into the existing campus BAS network as indicated on drawings.

C. Safety Interlocks: Primary condensate drain pan overflow switches and refrigerant leak detector alarm contacts shall be hardwired directly into equipment safety shutdown circuits to disable

heating and cooling operation independently of network communication status as indicated on drawings.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units (BACnet MSTP).

B. 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.

C. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

A. 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 -20 to 150 degrees F. (-29 to 65 degrees C.).
      b. Conditioned Space:
         1) Mount within dustproof enclosures.
         2) Rated for operation at 32 to 120 degrees F (0 to 50 degrees C).
   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 (1 m).

B. 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. 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.
5. Binary Outputs:
   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
   b. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
6. Analog Outputs:
   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
   b. Drift to not exceed 0.4 percent of range per year.

2.04 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: -20 to 150 degrees F (-29 to 65 degrees C).
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.

PART 3 EXECUTION

3.01 INSTALLERS

A. Installer List:
1. Powers of Arkansas.

3.02 EXAMINATION

A. Verify existing conditions before starting work.

B. 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.

3.03 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. Refer to Section 230993.

C. Provide conduit and electrical wiring in accordance with Section 260583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 232113 - HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment drains and overflows.

B. Pipe hangers and supports.

C. Unions, flanges, mechanical couplings, and dielectric connections.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels.

B. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.

D. ASTM B32 - Standard Specification for Solder Metal; 2020.

E. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

F. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

G. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

H. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2025a.

I. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.

J. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2024.

K. 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).

L. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.

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.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type M (C), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

B. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26.
   1. Fittings: ASTM D2466 or D2467, PVC.
   2. Joints: Solvent welded in accordance with ASTM D2855.

2.02 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
   3. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   4. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

B. 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:
   1. Bases: High-density polypropylene.
   2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
   3. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
   4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
   5. Height: Provide minimum clearance of 6 inches (150 mm) under pipe to top of roofing.
   6. Manufacturers:
      a. PHP Systems/Design: www.phpsd.com/#sle.
      b. Or approved equal.

2.03 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe of 2 Inches (50 mm, DN) and Less:
   1. Copper Pipe: Bronze, soldered joints.
   2. PVC Piping Unions: Schedule 40 PVC socket or threaded unions complying with ASTM D2466, equipped with EPDM O-ring seal, provided at equipment condensate drain outlets and cooling coil P-trap assemblies as indicated on drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

H. Slope piping and arrange to drain at low points.

I. Pipe Hangers and Supports:
   1. Install in accordance with MSS SP-58.
   2. Install hangers to provide minimum 1/2-inch (13 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Use hangers with 1-1/2 inches (38 mm) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   5. Provide copper plated hangers and supports for copper piping.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. See Section 230719.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 083100 .

3.03 SCHEDULES

A. Piping:
   1. Condensate piping interior to the building shall be copper or PVC. Provide insulation in compliance with Section 230719.
   2. Condensate piping exterior to the building shall be PVC.

B. Hanger Spacing for Copper Tubing.
   1. 1/2 Inch (15 mm) and 3/4 inch (20 mm): Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6 mm).
   2. 1 Inch (25 mm) and 1-1/4 Inch (32 mm) : Maximum span, 6 feet (1800 mm); minimum rod size, 1/4 inch (6 mm).

C. Hanger Spacing for Plastic Piping.
   1. 1/2 Inch (15 mm): Maximum span, 42 inches (1000 mm); minimum rod size, 1/4 inch (6 mm).
   2. 3/4 Inch (20 mm): Maximum span, 45 inches (1100 mm); minimum rod size, 1/4 inch (6 mm).
   3. 1 Inch (25 mm): Maximum span, 51 inches (1300 mm); minimum rod size, 1/4 inch (6 mm).
   4. 1-1/4 Inches (32 mm): Maximum span, 57 inches (1400 mm); minimum rod size, 3/8 inch (9 mm).
   5. 1-1/2 Inches (40 mm): Maximum span, 63 inches (1600 mm); minimum rod size, 3/8 inch (9 mm).

END OF SECTION

SECTION 232300 - REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Engineered wall seals and insulation protection.

D. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Addendum (2026).

B. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2024, with Addendum (2025).

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

D. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2022.

E. 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, with Errata.

F. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2023.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2024a.

I. 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; 2026.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

K. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

M. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013 (Reapproved 2021).

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2026.

O. AWS B2.2/B2.2M - Specification for Brazing Procedure and Performance Qualification; 2026.

P. IAPMO (UMC) - 2024 Uniform Mechanical Code; 2024.

Q. ICC (IMC) - International Mechanical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2025.

S. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

B. Technician Qualifications: Technicians performing brazing, pressure testing, evacuation, and refrigerant charging of mini-split systems shall hold current EPA Section 608 Universal or Type II Technician Certification.

1.06 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.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to maintain system integrity. Provide necessary joining fittings suitable for operating pressures and refrigerants.

B. Provide pipe hangers and supports in accordance with ASME B31.5 unless indicated otherwise.

2.02 REGULATORY REQUIREMENTS

A. Refrigerant Piping Standard: Fabricate and install refrigerant piping in accordance with ASME B31.5 .

B. Brazing Qualification: Qualify brazing processes and performance of brazers in accordance with AWS B2.2/B2.2M or ASME BPVC-IX for copper refrigerant piping as indicated on drawings.

C. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
   3. Mechanical Press Fittings: UL 207 listed, ICC (IMC) and IAPMO (UMC) approved, with HNBR seals.
   4. Flared Joints: SAE J513 45-degree flared joints constructed using annealed soft copper tubing, heavy-duty forged flare nuts, and eccentric flaring tools strictly adhering to equipment manufacturer torque specifications for unit factory connections where scheduled on drawings.

B. Preinsulated Refrigerant Piping Linesets:
   1. Copper Tube: ASTM B280 seamless, anticorrosion pipe; lineset is precoupled to include two joined pipes.
   2. Insulation: Polyethelene closed-cell foam; preapplied to entire length of lineset. Weather- and UV-resistant for outdoor installation. Maximum flame spread index of 25 and maximum smoke developed index of 50, when tested in accordance with ASTM E84 or UL 723.

C. Pipe Supports and Anchors:
   1. Provide hangers and supports complying with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron adjustable swivel, split ring.
   3. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   4. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   5. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 REFRIGERANT

A. 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.

B. Refrigerant: R-32 as defined in ASHRAE Std 34.

2.05 ENGINEERED WALL SEALS AND INSULATION PROTECTION

A. Basis of Design: Airex Manufacturing, Inc; www.airexmfg.com/#sle.
   1. Pipe Penetration Wall Seal: Airex Titan Outlet.
   2. Refrigeration Pipe Insulation Protection System: Airex E-Flex Guard.
   3. Pipe Penetration Wall Seal and Insulation Protection System: Airex Pro-System Kit.
   4. Pipe Penetration Wall Seal: Seals HVAC piping wall penetrations with compression gasket wall mounted rigid plastic outlet cover.
      a. Wall Outlet Size, Siding and Compact Applications: 6-7/8 inch wide by 3-7/8 inch high (175 mm wide by 99 mm high).
         1) Elastomeric Sleeve Diameter: 1-11/16 inch (43 mm).
      b. Outlet Cover Color: To be selected by Architect.
      c. Water Penetration: Comply with ASTM E331.
      d. Air Leakage: Comply with ASTM E283/E283M.
      e. Air Permeance: Comply with ASTM E2178.
   5. Insulation Protection System: Mechanical line insulation and PVC cover.
      a. PVC Insulation Cover Color: Black with full-length velcro fastener.
      b. Weatherization and Ultraviolet Exposure Protection: Comply with ASTM G153.
      c. Water/Vapor Permeability: Comply with ASTM E96/E96M.
      d. Anti-Fungal and Anti-Microbial Resistance: Comply with ASTM G21.
      e. Adhesive free.

2.06 EXTERIOR PENETRATION ACCESSORIES

A. Sealing Systems for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for linesets and facade materials to be installed.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

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. Route and size refrigerant lines strictly in accordance with equipment manufacturer written instruction guidelines to ensure proper compressor oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.5.
   2. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
   3. Place hangers within 12 inches (300 mm) of each horizontal elbow.
   4. Provide copper plated hangers and supports for copper piping.

G. Refrigerant Line Routing and Oil Return: Route refrigerant piping strictly in accordance with equipment manufacturer written instruction guidelines for maximum allowable line length, vertical elevation changes, and line sizing to ensure proper compressor oil return as indicated on drawings.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings.

J. Flood piping system with nitrogen when brazing.

K. Insulate piping.

L. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

M. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure Testing: Pressure test copper refrigerant piping with dry nitrogen to 550 psi (3790 kPa) or maximum allowable pressure specified by equipment manufacturer. Maintain test pressure for a minimum of 24 hours without pressure drop.

D. Evacuation: Evacuate refrigerant piping system using deep vacuum pump to a stable vacuum level of not less than 500 microns (66 Pa). Hold 500-micron vacuum for minimum 30 minutes with vacuum pump isolated before opening service valves or releasing refrigerant charge as indicated on drawings.

E. Leak Detection: Test all field flare joints, mechanical connections, and brazed joints using electronic leak detector rated for installed refrigerant or micro-leak detection bubble solution.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch (13 mm), 5/8 inch (16 mm), and 7/8 inch (22 mm) OD: Maximum span, 5 feet (1500 mm); minimum rod size, 1/4 inch (6.3 mm).

END OF SECTION

SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.

B. Flexible ducts.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting: Weld priming, weather resistant, paint or coating.

B. Section 099123 - Interior Painting: Weld priming, paint or coating.

C. Section 230130.51 - HVAC Air-Distribution System Cleaning: Post install duct cleaning.

D. Section 230713 - Duct Insulation: External insulation and duct liner.

E. Section 233300 - Air Duct Accessories.

F. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025a.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2027.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for duct materials, duct liner, and duct connections.

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. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

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.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide insulation and sound-absorbing liners in compliance with Section 230713.

C. Duct Shape and Material in accordance with Allowed Static Pressure Range:
   1. Round: Plus or minus 2 in-wc (500 Pa) of galvanized steel.
   2. Rectangular: Plus or minus 1 in-wc (250 Pa) of galvanized steel.
   3. Flexible Duct (Fabric and wire): Plus or minus 1 in-wc (250 Pa).

D. Duct Sealing and Leakage in accordance with Static Pressure Class:
   1. Low Pressure Service: Up to 2 in-wc (500 Pa):
      a. Seal: Class C, apply to seal off transverse joints.
      b. Leakage:
         1) Rectangular: Class 24 or 24 cfm/100 sq ft (680 Lpm/9.3 sq m).
         2) Round: Class 12 or 12 cfm/100 sq ft (340 Lpm/9.3 sq m).

E. Duct Fabrication Requirements:
   1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
   2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
   3. Construct tees, 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 airfoil turning vanes of perforated metal with glass fiber insulation.
   4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
   5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

2.02 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
   2. Galvanized Steel Exterior to Building: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Rectangular Metal Duct:
   1. Rectangular Single Wall: Rectangular, longitudinal lock seam duct with galvanized steel wall.
   2. Rectangular Double Wall Insulated (Interior to building): Rectangular, longitudinal lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.
      a. Outer Casing: 24-gauge G60 galvanized steel sheet metal.
      b. Inner Wall: Perforated 24-gauge galvanized steel sheet metal with L-shaped welded seams and outward flanges.
      c. Interstitial Insulation: 1" fiberglass insulation conforming to Section 230713.
   3. Rectangular Double Wall Insulated (Exterior to building): Rectangular, longitudinal lock seam duct with galvanized steel outer wall, solid galvanized steel inner wall; fitting with solid inner wall.
      a. Outer Casing: Heavy-gauge 18-gauge G90 galvanized steel sheet metal, with sloped top surface to prevent water pooling as indicated on drawings.
      b. Inner Wall: Solid 20-gauge galvanized steel sheet metal with L-shaped welded seams and outward flanges.
      c. Seams and Joints: Longitudinal seams constructed with Pittsburgh lock bedded in high-performance exterior duct sealant prior to closing. Transverse joints constructed with TDC flanges, continuous clips, bolts, and butyl gasket tape as indicated on drawings.
      d. Interstitial Insulation: Minimum R-8 thermal resistance fiberglass insulation conforming to Section 230713.

C. Round Metal Ducts:
   1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
   2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall. Exposed ductwork shall be constructed with paint lock metal.
      a. Insulation:
         1) Thickness: 1 inch (25 mm).
         2) Material: Fiberglass.
   3. Round Connection System: Interlocking duct connection system in accordance with SMACNA (DCS).

D. Connectors, Fittings, Sealants, and Miscellaneous:
   1. Fittings: Manufacture fittings for double-wall insulated ductwork with solid inner wall.
   2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
   3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
      a. 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.
      b. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
      c. For Use with Flexible Ducts: UL labeled.
   4. Gasket Tape:
      a. Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle ring connections.
   5. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 FLEXIBLE DUCTS

A. Flexible Air Ducts with Rip-Resistant Scrim:
   1. UL 181, Class 1, aluminum laminate and polyester vapor barrier with rip-resistant scrim reinforcement supported by helically wound spring steel wire.
   2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   3. Pressure Rating: From 10 in-wc (2.5 kPa) to 0.5 in-wc (175 Pa) negative.
   4. Maximum Velocity: 4,000 fpm (20.3 m/s).
   5. Temperature Range: Minus 20 to 175 degrees F (Minus 28 to 79 degrees C).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Flexible Ducts: Connect to metal ducts with draw bands.

G. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use double nuts and lock washers on threaded rod supports.

J. Connect diffusers or light troffer boots to low-pressure ducts directly or with 3 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

K. Duct Accessories, Inlets, and Outlets: Interconnect as indicated in Sections 233300 and 233700.

L. Duct Insulation: Provide duct insulation. See Section 230713.

M. Painting: Provide surface finish as indicated on drawings. See Sections 099113 and 099123.

3.02 SCHEDULE

A. Supply:
   1. Exterior: Double-wall, rectangular, solid liner, 3" fiberglass interstitial insulation, minimum R-value of 8.
   2. Exposed: Double-wall, spiral, round, perforated liner, 1" fiberglass interstitial insulation.
   3. RTU plenums and where noted elsewhere on plans: Double-wall, rectangular, perforated liner, 1" fiberglass interstitial insulation.
   4. Concealed: Single-wall, round or rectangular, external 2" fiberglass duct wrap.

B. Return:
   1. Exterior: Double-wall, rectangular, solid liner, 3" fiberglass interstitial insulation, minimum R-value of 8.
   2. RTU plenums and where noted elsewhere on plans: Double-wall, rectangular, perforated liner, 1" fiberglass interstitial insulation.
   3. Concealed: Single-wall, round or rectangular. Insulation not required.

C. Exhaust:
   1. Within 10'-0" of Exterior Termination: Single-wall, round or rectangular, external 2" fiberglass duct wrap.
   2. Concealed: Single-wall, round or rectangular. Insulation not required.

3.03 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean thoroughly each duct system.

END OF SECTION

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Duct access doors.

C. Duct test holes.

D. Flexible duct connectors.

E. Volume control dampers.

F. Miscellaneous Products:
   1. Damper operators.
   2. Duct opening closure film.

G. Air turning devices.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide for shop-fabricated assemblies including volume control dampers and hardware used. Include 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.

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 (450 by 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.02 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. Lloyd Industries, Inc: www.firedamper.com/#sle.
   5. Nailor Industries, Inc: www.nailor.com/#sle.
   6. Ruskin Company: www.ruskin.com/#sle.
   7. Or approved equal.

B. Construction: Double-wall galvanized steel access door assembly with continuous neoprene gasket seal and heavy-duty zinc-plated steel cam locks or hinges.

C. Insulation: Provide fiberglass or polyurethane foam insulation fill between double walls matching thermal resistance (R-value) of adjacent insulated ductwork as indicated on drawings.

2.03 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.04 FLEXIBLE DUCT CONNECTORS

A. Manufacturers:
   1. Carlisle HVAC Products: www.carlislehvac.com/#sle.
   2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
   3. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
   4. Or equal.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. 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/sq yd (1.0 kg/sq m).
   2. Metal: 3 inches (75 mm) wide, 24 gauge, 0.0239 inch (0.61 mm) thick galvanized steel.

D. Maximum Installed Length: 14 inch (356 mm).

2.05 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Nailor Industries, Inc: www.nailor.com/#sle.
   2. Pottorff: www.pottorff.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:
   1. Blade: 24 gauge, 0.0239 inch (0.61 mm), minimum.

D. Multi-Blade Damper: Fabricate consisting of opposed blades with maximum blade sizes 8 by 72 inches (200 by 1825 mm). Assemble center- and edge-crimped blades in prime-coated or galvanized-channel frame with suitable hardware.
   1. Blade: 18 gauge, 0.0478 inch (1.21 mm), minimum.

E. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

F. 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 (750 mm) provide regulator at both ends.

2.06 MISCELLANEOUS PRODUCTS

A. Damper Operators: Provide manual operators.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
   1. Thickness: 2 mils (0.6 mm).
   2. High tack water based adhesive.
   3. UV stable light blue color.
   4. Elongation Before Break: 325 percent, minimum.

2.07 AIR TURNING DEVICES

A. Manufacturers: Carlisle HVAC Products, Elgen Manufacturing Company, Inc, Krueger-HVAC, Ruskin Company, or Titus HVAC.

B. Turning Vanes: Factory-fabricated double-wall curved turning vanes constructed of galvanized steel, mounted in continuous factory vane runners/rails complying with SMACNA (DCS) as indicated on drawings.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct test holes where required for testing and balancing purposes.

D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

F. Provide balancing dampers at points on supply and return systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

G. 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.

H. Provide duct access doors for inspection and cleaning at turning vanes, internal dampers, and elsewhere as indicated on drawings. Provide minimum 12 by 12 inch (300 by 300 mm) size access doors, or maximum size feasible based on duct dimensions, at turning vanes unless otherwise indicated on drawings.

END OF SECTION

SECTION 233423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

B. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2025.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2025.

E. AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

G. UL 507 - Electric Fans; Current Edition, Including All Revisions.

H. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are completed in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories, including fan curves with specified operating point plotted, power, rpm, sound power levels at rated capacity, and electrical characteristics and connection 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Greenheck Fan Corporation: www.greenheck.com/#sle.

C. Loren Cook Company: www.lorencook.com/#sle.

D. PennBarry, Division of Air System Components: www.pennbarry.com/#sle.

E. Twin City Fan & Blower: www.tcf.com/#sle.

F. Or approved equal.

2.02 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: Comply with AMCA 204.

B. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

C. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL 507 or UL 705, listed, labeled, designed, manufactured, and tested.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.03 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing, resiliently mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor.

C. Grille: Aluminum.

D. Performance Ratings: As indicated on drawings.

E. Speed Controller: Provide factory-installed, solid-state electronic speed controller integral to fan assembly for capacity adjustment as indicated on drawings.

F. Mounting Accessories: Provide mounting brackets, suspension rods, and resilient rubber-in-shear vibration isolators suitable for ceiling installation as indicated on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
   1. Install fans with resilient mountings and flexible electrical leads, see Section 230548.
   2. Install flexible connections between fan and ductwork; see Section 233300. Ensure metal bands of connectors are parallel with minimum 1 inch (25 mm) flex between ductwork and fan while running.

C. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grilles, registers, and diffusers

B. Gravity ventilators.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

B. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.

C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. 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 GRILLES, REGISTERS, AND DIFFUSERS

A. Manufacturers
   1. Krueger-HVAC: www.krueger-hvac.com/#sle.
   2. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.
   3. Price Industries: www.priceindustries.com/#sle.
   4. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.
   5. Or approved equal.

B. As scheduled on drawings.

C. Accessories:
   1. Opposed Blade Dampers: Provide neck-mounted opposed blade volume dampers adjustable from the face of the device where indicated on drawings.
   2. Diffuser Back Panel Insulation: Provide factory-applied or field-installed insulated back panels on supply diffusers. Insulation material and thickness shall match connected supply ductwork insulation.
   3. Insulated Plenums: Provide manufacturer-furnished insulated plenum boots for linear supply diffusers where indicated on drawings.

2.02 GRAVITY VENTILATORS

A. Spun Aluminum Relief Gravity Ventilator:

1. Manufacturers:
   a. Greenheck Fan Corporation: www.greenheck.com/#sle.
   b. Loren Cook Company: www.lorencook.com/#sle.
   c. Or approved equal.
2. General:
   a. Performance ratings and factory testing in accordance with AMCA 511 and AMCA 550.
   b. Equipment to bear permanently affixed manufacturer's nameplate listing model and serial number.
3. Hood:
   a. Material: Aluminum.
   b. Internal structure constructed of galvanized steel.
4. Birdscreen:
   a. Fabricate in accordance with ASTM B221 (ASTM B221M).
   b. Construction: 1/2 inch (12.7 mm) galvanized mesh.
   c. Horizontally mounted across hood intake area.
5. Housing:
   a. Curb Cap:
      1) Type: No Hinged.
      2) Construction: Aluminum.
      3) Integral deep spun inlet venturi with pre-punched mounting holes to ensure correct attachment to roof.
   b. Windband:
      1) One piece spun aluminum construction with uniform, original material thickness throughout housing.
      2) Include integral rolled bead for strength.
6. Options/Accessories:
   a. Roof Curbs:
      1) Flat Roofs:
         (a) Welded, straight side curb with flashing flange and wood nailer.
      2) Material: Aluminum.
      3) Insulation Thickness: 1 inch (25.4 mm).
   b. Curb Seal: Rubber seal between fan and roof curb.
   c. Dampers:
      1) Type: Gravity.
      2) Factory designed to prevent outside air from entering back into building when fan is off.
      3) Balanced for minimal resistance to flow.
      4) Galvanized frames with pre-punched mounting holes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black, see Section 099123.

3.02 CLOSEOUT ACTIVITIES

A. Demonstrate operational system to Owner's representative.

B. Instruct Owner's representative to maintain system and use occupant controls or interfaces, as required.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Replace, repair, or touch-up damaged products before Substantial Completion.

END OF SECTION

SECTION 237417 - PACKAGED AIR-CONDITIONING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged Air-Conditioning Units

1.02 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements 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. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements for additional provisions.
   2. Extra Filters: One set for each unit.

E. BACnet Variable Point List: Equipment supplier shall provide the Controls Contractor with a complete BACnet Variable Point List and Protocol Implementation Conformance Statement (PICS) identifying all available control, monitoring, setpoint, and diagnostic/leak alarm points prior to field integration.

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 017800 - Closeout Submittals for additional warranty requirements.

B. Provide a five year warranty to include coverage for compressors and heat exchangers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products shall be provided by the following manufacturers:
   1. Substitute equipment may be considered for approval that includes at a minimum:
      a. R-454B refrigerant
      b. Compressors with capacities and staging as indicated on drawings
      c. Direct drive supply fans
      d. Double wall cabinet construction
      e. Insulation with a minimum R-value of 13
      f. Stainless steel drain pans
      g. Hinged access doors with lockable handles
      h. All other provisions of the specifications must be satisfactorily addressed
   2. Aaon: www.aaon.com/#sle.
   3. Daikin: www.daikinapplied.com/#sle.
   4. Johnson Controls International, PLC: www.johnsoncontrols.com/#sle.

B. Products by the following manufacturers shall *NOT* be allowed:
   1. American Standard.
   2. Trane.

2.02 PACKAGED AIR-CONDITIONING UNITS

A. General Description
   1. Packaged rooftop unit shall include:
      a. Evaporator coils
      b. Filters
      c. Supply fans
      d. Dampers
      e. Two-step or variable speed compressors
      f. Air-cooled condenser coils and condenser fans
      g. Reheat coil (where scheduled on drawings)
      h. Gas heaters
      i. Unit controls
   2. Unit shall be factory assembled and tested including leak testing of the DX coils, pressure testing of the refrigeration circuit, and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment's literature pocket.
   3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
   4. Unit components shall be labeled, including refrigeration system components and electrical and controls components.
   5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
   6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
   7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment's hinged access door.
   8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment's hinged access door.

B. Construction
   1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
   2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929-11 for a minimum flash ignition temperature of 610°F.
   3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.
   4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
   5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
   6. Access to filters, dampers, cooling coils, reheat coil, heaters, compressors, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.

7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9. Unit shall be provided with discharge and return air openings as indicated on drawings. Openings shall have upturned flanges of at least 1/2 inch in height around the opening.
10. Unit base pan shall be provided with 1/2 inch thick foam insulation.
11. Unit shall include factory installed, painted galvanized steel condenser coil guards on the face of the condenser coil.

C. Electrical
1. Unit shall be provided with factory installed and factory wired, non-fused disconnect switch.
2. Unit shall have a 10 kAIC SCCR.
3. Unit shall be provided with a factory installed and factory wired 115V, 12 amp GFI outlet disconnect switch in the unit control panel.
4. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.

D. Supply Fans
1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.
5. Motor shall include shaft grounding
6. Unit shall include barometric relief dampers.

E. Evaporator Coils
1. Coils shall be designed for use with R-454B refrigerant and constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
2. Coils shall be 6 row high capacity.
3. Coils shall be hydrogen or helium leak tested.
4. Coils shall be furnished with factory installed expansion valves.

F. Refrigeration System
1. Unit shall be factory charged with R-454B refrigerant.
2. Compressors shall be scroll type with thermal overload protection and carry a 5 year non-prorated warranty, from the date of original equipment shipment from the factory.
3. Compressors shall be mounted in an isolated service compartment which can be accessed without affecting unit operation. Lockable hinged compressor access doors shall be fabricated of double wall, rigid polyurethane foam injected panels to prevent the transmission of noise outside the cabinet.
4. Compressors shall be isolated from the base pan with the compressor manufacturer's recommended rubber vibration isolators, to reduce any transmission of noise from the compressors into the building area.
5. Each refrigeration circuit shall be equipped with expansion valve type refrigerant flow control.
6. Each refrigeration circuit shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant safety controls, Schrader type service fittings on both the high pressure and low pressure sides and a factory installed liquid line filter driers.
7. Unit shall include minimum 2 stages of capacity control.
8. Unit shall include a two-stage compressor that shall modulate between two capacity settings, 67% and 100% or variable speed compressor.

9. Where scheduled on drawings, refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.
    a. Reheat coil shall be multi-pass and fabricated from aluminum microchannel tubes.
10. Where scheduled on darwings, refrigeration circuit shall be provided with factory installed hot gas bypass to protect against evaporator frosting and to prevent excessive compressor cycling.
11. Refrigeration circuit shall be provided with an adjustable temperature sensor freeze stat which shuts down the cooling circuit when the evaporator coil tubing falls below the setpoint.

G. Air-Cooled Condenser
1. Condenser fans shall be a vertical discharge, axial flow, direct drive fans.
2. Coils shall be designed for use with R-454B refrigerant. Coils shall be multi-pass and fabricated from aluminum microchannel tubes.
3. Coils shall be designed for a minimum of 10°F of refrigerant sub-cooling.
4. Coils shall be hydrogen or helium leak tested.
5. Condenser fans shall be high efficiency electrically commutated motor driven with factory installed head pressure control module. Condenser airflow shall continuously modulate based on head pressure and cooling operation shall be allowed down to 35°F with adjustable compressor lockout.

H. Gas Heating
1. Stainless steel heat exchanger furnace shall carry a 25 year non-prorated warranty, from the date of original equipment shipment from the factory.
2. Gas furnace shall consist of stainless steel heat exchangers with multiple concavities, an induced draft blower and an electronic pressure switch to lockout the gas valve until the combustion chamber is purged and combustion airflow is established.
3. Furnace shall include a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
4. Modulating Natural Gas Furnace shall be equipped with modulating gas valves, adjustable speed combustion blowers, stainless steel tubular heat exchangers, and electronic controller. Combustion blowers and gas valves shall be capable of modulation. Electronic controller includes a factory wired, field installed supply air temperature sensor. Sensor shall be field installed in the supply air ductwork. Supply air temperature setpoint shall be adjustable on the electronic controller within the controls Gas heater shall be capable of capacity turndown ratio as shown on the unit rating sheet.

I. Filters
1. Unit shall include 2 inch thick, pleated panel filters with an ASHRAE MERV rating of 8, upstream of the cooling coil.
2. Unit shall include a clogged filter switch for the unit filters.

J. Outside Air/Economizer
1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals. Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper. Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Unit shall include outside air opening bird screen and outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.
    a. Damper assembly shall be controlled by spring return enthalpy activated fully modulating actuator.

b. Economizer shall be furnished with return air CO2 override.

K. Factory Installed and Factory Provided Controller
1. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested. Controller shall be capable of stand alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
2. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
3. Controller shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.
4. Constant Volume Controller
a. Unit shall modulate cooling with constant airflow to meet space temperature cooling loads.
b. Where scheduled on drawings with modulating hot gas reheat, unit shall modulate cooling and hot gas reheat as efficiently as possible, to meet space humidity loads and prevent supply air temperature swings and overcooling of the space.
c. Unit shall modulate heating with constant airflow to meet space temperature heating loads. Modulating heating capacity shall modulate based on supply air temperature.
5. Unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling shall be accomplished with connection to interface module with LCD screen and input keypad, interface module with touch screen, or with connection to PC with free configuration software. Controller shall be capable of connection with other factory installed and factory provided unit controllers with individual unit configuration, setpoint adjustment, sensor status viewing, and occupancy scheduling available from a single unit. Connection between unit controllers shall be with a modular cable. Controller shall be capable of communicating and integrating with a LonWorks or BACnet network.
6. Combination Space Sensor: Equipment manufacturer shall furnish a wall-mounted combination space temperature and relative humidity sensor (with 24 VAC power and communication wiring interface) for field installation and wiring by the Controls Contractor as indicated on drawings.

L. Accessories
1. Unit shall be provided with a high condensate level switch that shuts down the unit when a high water level is detected in the drain pan.
2. Provide with plenum curb for horizontal discharge.
3. Refrigerant Detection System (RDS): Factory-installed, UL 60335-2-40 listed internal A2L refrigerant detection system with sensors positioned inside the evaporator coil and fan compartment. Upon detection of R-454B refrigerant leakage, onboard controls shall automatically initiate factory safety mitigation (energizing supply fan for continuous air dilution, de-energizing compressors) and transmit an A2L leak alarm point over the factory BACnet interface to the central campus BAS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof 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. Install in accordance with NFPA 90A.

C. 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.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

3.05 FIELD QUALITY CONTROL

A. Condensate Float Switch: Test primary drain pan overflow switch to verify automatic compressor lockout upon high water level.

B. Return Air Smoke Detector: Test duct smoke detectors to confirm immediate unit fan shutdown and alarm transmission to the building fire alarm panel.

C. A2L Leak Detection System (RDS): Simulate an A2L leak signal to confirm onboard safety mitigation (supply fan purge, compressor trip) and BAS alarm point generation.

D. BACnet Integration: Coordinate with Division 23/25 Controls Contractor to verify two-way BACnet MS/TP data transmission for space temperature/humidity, setpoints, operating status, and diagnostic alarms.

END OF SECTION

SECTION 238126.13 - 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 ductless systems.

C. Controls.

1.02 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2026.

B. AHRI 270 (SI/I-P) - Sound Performance Rating of Outdoor Unitary Equipment; 2025.

C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Addendum (2026).

E. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

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. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Filters: One for each unit.

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. Installer Qualifications: Company specializing in performing the work of this section with minimum three years of experience.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Daikin

B. LG

C. Mitsubishi

D. Samsung

E. Or approved equal.

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.
   2. 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 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. Location: High-wall.
   2. Cabinet: Galvanized steel.
      a. Finish: White.
   3. Fan: Line-flow fan direct driven by a single motor.
   4. 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. Manufacturer: System manufacturer.

C. Condensate Overflow Safety Switch: Provide a factory- or field-installed low-voltage condensate overflow switch specifically designed for mounting inside ductless high-wall indoor unit drain pans or primary drain outlets.
   1. Switch shall feature normally-closed (NC) solid-state water sensing probes or a magnetic float sensor.
   2. Switch shall be wired directly to the indoor unit internal control board shut-off terminals to automatically de-energize cooling operation and stop compressor function upon detection of high condensate level in the primary drain pan prior to overflow.

D. A2L Refrigerant Safety & Leak Detection System (RDS):
   1. Indoor unit assembly shall comply fully with UL 60335-2-40 and ASHRAE 15 requirements for A2L (R-32) refrigerants.
   2. Where required by equipment charge limits and occupied space volume, provide factory-installed or manufacturer-certified internal Refrigerant Detection System (RDS) sensor inside the indoor unit cabinet.
   3. Upon detection of refrigerant leakage, the onboard controls shall automatically initiate factory mitigation measures (energizing indoor unit fan for air dispersion and de-energizing outdoor unit compressor).
   4. Internal RDS sensor shall provide a dry-contact alarm output or BACnet alarm point to signal the central BAS upon a leak event.

2.04 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 powder 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 and UL 207.

5. Sound Rating: 52 dBA, when measured in accordance with AHRI 270 (SI/I-P).

B. Compressor: Inverter-driven, variable-speed twin rotary compressor, equipped with soft-start capability, internal motor overload protection, crankcase heater, high-pressure safety cutout, and internal vibration isolation.

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.
   2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

D. 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.
   3. Base Pan Heater: Provide factory-installed or manufacturer-approved electric base pan heater kit, interlocked with unit defrost controls to automatically energize during low-ambient heating and defrost cycles, preventing ice accumulation and freeze-up in the outdoor unit chassis drain pan.

E. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).

2.05 ACCESSORY EQUIPMENT

A. Provide manufacturer-furnished microprocessor wired wall controller, 2-wire bus powered, with digital LCD display, temperature adjustment, mode selection, and lockout features.

B. BACnet Gateway Interface Module: Provide factory-supplied BACnet MS/TP interface gateway module enabling full two-way communication, temperature setpoint adjustment, operating status, fan speed control, and diagnostic/leak alarm monitoring between mini-split internal controls and the central BAS.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

3.02 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 cooling coils as indicated on drawings.

3.03 FIELD QUALITY CONTROL

A. System Start-Up & Safety Interlock Testing: Perform field verification and start-up testing in accordance with manufacturer instructions. Verify proper operation of the following safety interlocks and control interfaces prior to system acceptance:
   1. Condensate Overflow Interlock: Test the primary drain pan safety float switch on indoor unit DS-1 to confirm it automatically de-energizes outdoor compressor CU-1 upon high water detection.
   2. Low-Ambient Cooling: Verify continuous cooling operation of outdoor unit CU-1 down to 0°F outdoor ambient temperature to maintain Room 104 IT/DATA space conditions.

3. BAS Integration Verification: Coordinate with Division 23/25 Controls Contractor to verify two-way BACnet MS/TP communication, setpoint adjustment, run/fault status, and A2L leak alarm point mapping back to the campus BAS.

END OF SECTION

SECTION 238200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric unit heaters.

1.02 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

1.05 QUALITY ASSURANCE

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

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com/#sle.
   2. Marley Engineered Products: www.marleymep.com/#sle.
   3. Or approved equal.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL) or Intertek (ETL) as suitable for purpose indicated.

C. Heating Element Assembly:
   1. Thermal safety cut-out within electric terminal box with automatically reset switch located near electric terminal box.
   2. Aluminum-finned, copper clad steel sheath heating element has longer useful life, because of cooler sheath temperature and faster heat dissipation.

D. Housing:
   1. Suitable for ceiling or high altitude mount using provided hardware appendages.
   2. Heavy gauge die-formed steel housing with adjustable steel directional louvers.
   3. Horizontal Projection Units:
      a. Construction materials to consist of heavy gauge steel with polyester powder coat finish.
      b. Provisions for access to internal components for maintenance, adjustments, and repair.

E. Air Inlets and Outlets:
   1. Inlets: Provide protective grilles with fan blade guard.
   2. Outlets: Provide directional louvers.

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. Fan override to purge residual heat when de-energized.
2. Built-in line-voltage thermostat.

I. Electrical Characteristics: As scheduled on drawings.

J. Accessories:
1. Provide with wall mounting brackets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Unit Heaters:
1. Hang from building structure, with hangers anchored to building, not from piping or electrical conduit.
2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

C. Units with Electric Heating Elements:
1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 260583.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Metal-clad cable.

C. Wiring connectors.

D. Electrical tape.

E. Heat shrink tubing.

F. Oxide inhibiting compound.

G. Wire pulling lubricant.

H. Cable ties.

I. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 260526 - 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 B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2021).

F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation; 2018 (Reapproved 2023).

G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2024.

H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

J. FM 3971 - Fire Protective Coatings and Wraps for Grouped Cables; 2019.

K. IEEE 383 - IEEE Standard for Qualifying Electric Cables and Splices for Nuclear Facilities; 2015.

L. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

M. NECA 104 - Standard for Installing Aluminum Building Wire and Cable; 2012.

N. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.

O. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.

P. NETA ATS - Standard for Acceptance Testing Specifications for Electrical Power Equipment And Systems; 2025.

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

R. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

S. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

T. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

U. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

V. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

W. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

X. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

Y. UL 1569 - Metal-Clad Cables; 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. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

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 (-10 degrees C), 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.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:
   1. Where not otherwise restricted, may be used:
      a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
         1) Maximum Length: 6 feet (1.8 m).
      b. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
         1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
   2. In addition to other applicable restrictions, may not be used:
      a. Unless approved by Owner.
      b. Where not approved for use by the authority having jurisdiction.
      c. Where exposed to damage.
      d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

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. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 260526.

I. Conductor Material:
   1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
         1) Services: Copper conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
         3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
         4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.
   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.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      a. Exceptions:
         1) 20 A, 120 V circuits longer than 75 feet (23 m): 10 AWG, for voltage drop.
         2) 20 A, 120 V circuits longer than 150 feet (46 m): 8 AWG, for voltage drop.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. 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.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation; _____: www.generalcable.com/#sle.
      d. Service Wire Co: www.servicewire.com/#sle.
      e. Southwire Company: www.southwire.com/#sle.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
      a. Encore Wire Corporation: www.encorewire.com/#sle.
      b. Southwire Company: www.southwire.com/#sle.
      c. Stabiloy, a brand of General Cable Technologies Corporation; _____: www.stabiloy.com/#sle.

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. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Service Wire Co: www.servicewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor.

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.
   2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
   3. Connectors for Aluminum Conductors: Use 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. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   5. Aluminum Conductors: Use compression connectors for all connections.
   6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.

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 (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.

G. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC; _____: www.burndy.com/#sle.
      b. nVent ILSCO: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:

a. Burndy LLC; _____: www.burndy.com/#sle.
b. nVent ILSCO: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
1. Manufacturers:
a. Burndy LLC; _____: www.burndy.com/#sle.
b. Ilsco: www.ilsco.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.06 ACCESSORIES

A. Electrical Tape:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil (3.2 mm); suitable for continuous temperature environment up to 176 degrees F (80 degrees C).
6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil (0.18 mm); suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).

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.
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. Burndy LLC; _____: www.burndy.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
a. Burndy LLC; _____: www.burndy.com/#sle.
b. Ideal Industries, Inc: www.idealindustries.com/#sle.
c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant:
1. Manufacturers:
a. 3M: www.3m.com/#sle.
b. American Polywater Corporation: www.polywater.com/#sle.
c. Ideal Industries, Inc: www.idealindustries.com/#sle.
2. Listed and labeled as complying with UL 267.

3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
4. Suitable for use at installation temperature.
5. Products:
   a. American Polywater Corporation; Polywater J Cable Pulling Lubricant: www.polywater.com/#sle.
   b. American Polywater Corporation; Polywater LZ Cable Pulling Lubricant: www.polywater.com/#sle.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
   a. Burndy LLC; _____: www.burndy.com/#sle.

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.
1. Products:
   a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
   b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

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.

H. Fire-Protective Coating for Electrical Conductors and Cables: Field-applied, intumescent or ablative coating designed to prevent ignition and propagation of fire along thermoplastic-insulated conductors and cables.
1. Pass flammability tests of one of the following:
   a. ASTM E84, Class A; maximum flame spread index of 25.
   b. FM 3971.
   c. IEEE 383.

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. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
8. 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.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install aluminum conductors in accordance with NECA 104.

E. Install metal-clad cable (Type MC) in accordance with NECA 120.

F. 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.

G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

H. 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.

I. 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.

J. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. 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.
   1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
   2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
      a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
      b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
   3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. 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.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. 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.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
   1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 260526 - 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. Ground enhancement material.

G. Ground access wells.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

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. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. 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.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. 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.

E. 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 (3.0 m) at an accessible location not more than 5 feet (1.5 m) 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 (6.0 m) 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 (3.0 m) from each other and any other ground electrode.
      c. Where location is not indicated, locate electrode(s) at least 5 feet (1.5 m) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
      d. Provide ground enhancement material around electrode where indicated.
      e. Provide ground access well for each electrode.
   6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. 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.

G. 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:
   a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
   b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

H. 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 (21 mm) trade size unless otherwise indicated or required.
   c. Ground Bar Size: 1/4 by 2 by 12 inches (6 by 50 by 300 mm) unless otherwise indicated or required.
   d. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.

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 260526:
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.
a. Exceptions:
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
a. Exceptions:
4. Manufacturers - Mechanical and Compression Connectors:
a. allG Fabrication; _____: www.allgfab.com/#sle.
b. Burndy LLC; _____: www.burndy.com/#sle.
c. Harger Lightning & Grounding; _____: www.harger.com/#sle.
d. nVent ERICO; _____: www.nvent.com/#sle.
e. Thomas & Betts Corporation; _____: www.tnb.com/#sle.
5. Manufacturers - Exothermic Welded Connections:
a. Burndy LLC; _____: www.burndy.com/#sle.
b. nVent ERICO; Cadweld: www.nvent.com/#sle.
c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

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. allG Fabrication; _____: www.allgfab.com/#sle.
b. Harger Lightning & Grounding; _____: www.harger.com/#sle.
c. nVent ERICO; _____: www.nvent.com/#sle.
d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

E. Ground Rod Electrodes:
1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch (19 mm) diameter by 10 feet (3.0 m) length, unless otherwise indicated.
4. Manufacturers:
a. allG Fabrication; _____: www.allgfab.com/#sle.
b. Galvan Industries, Inc; _____: www.galvanelectrical.com/#sle.
c. Harger Lightning & Grounding; _____: www.harger.com/#sle.
d. nVent ERICO; _____: www.nvent.com/#sle.

F. Ground Enhancement Material:
1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.

G. Ground Access Wells:
1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
a. Round Wells: Not less than 8 inches (200 mm) in diameter.
b. Rectangular Wells: Not less than 12 by 12 inches (300 by 300 mm).

3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches (250 mm).
4. Cover: Factory-identified by permanent means with word "GROUND".
5. Manufacturers:
   a. allG Fabrication; _____: www.allgfab.com/#sle.
   b. Harger Lightning & Grounding; _____: www.harger.com/#sle.
   c. nVent ERICO; _____: www.nvent.com/#sle.
   d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; _____: www.thermoweld.com/#sle.

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.

D. 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.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

END OF SECTION

SECTION 260529 - 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 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

E. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

F. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior 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. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2026a.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

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

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 5B - Strut-Type Channel Raceways and Fittings; 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 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. 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. Fiberglass Channel/Strut Framing Systems: Include requirements for strength derating according to ambient temperature.

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 with minimum safety factor of _____. 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. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   7. 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. Materials for Metal Fabricated Supports: See Section 055000.

C. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
   1. Manufacturers:
      a. ABB: www.electrification.us.abb.com/#sle.
      b. Eaton Corporation: www.eaton.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
      d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
   2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
   3. Conduit Clamps: Bolted type unless otherwise indicated.
   4. Products:
      a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
      b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
      c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.

d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.

D. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
1. Manufacturers:
a. ABB: www.electrification.us.abb.com/#sle.
b. Eaton Corporation: www.eaton.com/#sle.
c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.

E. Metal Channel/Strut Framing Systems:
1. Manufacturers:
a. ABB: www.electrification.us.abb.com/#sle.
b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
c. Eaton Corporation: www.eaton.com/#sle.
d. Elgen Manufacturing Company, Inc; _____: www.elgenmfg.com/#sle.
e. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
2. Description: 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/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
5. Channel Material:
a. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm).
7. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 13/16 inch (21 mm) high.

F. Fiberglass Channel/Strut Framing Systems:
1. Manufacturers:
a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
b. Champion Fiberglass: www.championfiberglass.com/#sle.
c. Eaton Corporation: www.eaton.com/#sle.
d. Enduro Composites: www.endurocomposites.com/#sle.
e. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
2. Description: Factory-fabricated, continuous-slot, fiberglass channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
3. Channel Material: Use polyester resin or vinyl ester resin.
4. Minimum Channel Dimensions: 1-5/8 inch (41 mm) wide by 1 inch (25 mm) high.
5. Flammability: Fire retardant with NFPA 101, Class A flame spread index, maximum of 25, when tested in accordance with ASTM E84; self extinguishing in accordance with ASTM D635.

G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
a. Equipment Supports: 1/2-inch (13 mm) diameter.
b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch (6 mm) diameter.
c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch (10 mm) diameter.
d. Trapeze Support for Multiple Conduits: 3/8-inch (10 mm) diameter.
e. Outlet Boxes: 1/4-inch (6 mm) diameter.
f. Luminaires: 1/4-inch (6 mm) diameter.

H. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
a. Dewalt: anchors.dewalt.com/#sle.
b. Hilti, Inc: www.hilti.com/#sle.
c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.

d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.

2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Dewalt: anchors.dewalt.com/#sle.
   b. Hilti, Inc: www.hilti.com/#sle.
   c. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are not permitted.
13. Hammer-driven anchors and fasteners are not permitted.
14. 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 (2.66 mm) 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. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Box Support and Attachment: See Section 260533.16 for additional requirements.

J. Interior Luminaire Support and Attachment: See Section 265100 for additional requirements.

K. Exterior Luminaire Support and Attachment: See Section 265600 for additional requirements.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners in accordance with manufacturer's recommended torque settings.

N. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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

SECTION 260533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Stainless steel rigid metal conduit (RMC).
C. Aluminum rigid metal conduit (RMC).
D. Galvanized steel intermediate metal conduit (IMC).
E. Stainless steel intermediate metal conduit (IMC).
F. PVC-coated galvanized steel rigid metal conduit (RMC).
G. Flexible metal conduit (FMC).
H. Liquidtight flexible metal conduit (LFMC).
I. Galvanized steel electrical metallic tubing (EMT).
J. Stainless steel electrical metallic tubing (EMT).
K. Aluminum electrical metallic tubing (EMT).
L. Rigid polyvinyl chloride (PVC) conduit.
M. Electrical nonmetallic tubing (ENT).
N. Liquidtight flexible nonmetallic conduit (LFNC).

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 078400 - Firestopping.
C. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
D. Section 260529 - Hangers and Supports for Electrical Systems.
E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
F. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.
G. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

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); 2017.
I. NEMA BI 50058 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).
J. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
K. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit; 2018.

L. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

M. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.

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 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.

X. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

Y. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

Z. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

AA. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; 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. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

1.06 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, 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).
   3. 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.
   4. 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.
   5. 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.
   6. 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 (100 mm) 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. 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 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).

F. 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).

G. 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).

H. 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).

I. 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).

J. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).

K. 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 (1.8 m) unless otherwise indicated.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Electrical Service Conduits: See Section 262100 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 260526 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 (21 mm) trade size.
   3. Control Circuits: 1/2-inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8-inch (12 mm) trade size.
   5. Underground, Interior: 3/4-inch (21 mm) trade size.
   6. Underground, Exterior: 1-inch (27 mm) 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, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
   2. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
   3. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
   4. Rymco USA: www.rymcousa.com/#sle.

B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.

C. Fittings:
   1. Manufacturers:
      a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
      b. Eaton: www.eaton.com/#sle.
      c. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
      d. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
   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 stainless steel with corrosion resistance equivalent to conduit.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 ALUMINUM RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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. ABB; T&B: www.electrification.us.abb.com/#sle.
   b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
   c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
   d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
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.

2.06 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular.com/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.07 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.

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. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
      b. Eaton: www.eaton.com/#sle.
   2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.08 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. ABB; Ocal: www.electrification.us.abb.com/#sle.
   2. Calbond, a division of Atkore International www.calbond.com/#sle
   3. Robroy Industries: www.robroy.com/#sle.

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 (1.02 mm).

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. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil, 0.040 inch (1.02 mm).

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil, 0.015 inch (0.38 mm).

2.09 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.

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. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.10 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.

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. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.11 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. Nucor Tubular Products: www.nucortubular/#sle.
   3. Rymco USA: www.rymcousa.com/#sle.
   4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
   5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.

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. Factory-Painted, Color-Coded Galvanized Steel EMT: Apply according to indicated color code.
   1. See Section 260553 for color code.
   2. Products:
      a. Rymco USA; Real Color: www.rymcousa.com/#sle.

D. Fittings:
   1. Manufacturers:
      a. ABB; T&B: www.electrification.us.abb.com/#sle.
      b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
      c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
      d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.
   4. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.12 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.

B. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.

C. Fittings:
   1. Manufacturers:
      a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Connectors and Couplings: Use compression/gland or set-screw type.
   4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.13 ALUMINUM ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. American Conduit, a division of Hydro: www.americanconduit.com/#sle.

B. Description: NFPA 70, Type EMT aluminum electrical metallic tubing listed and labeled as complying with UL 797A.

C. Fittings:
   1. Manufacturers:
      a. Arlington Industries: www.aifittings.com/#sle.
      b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; listed for use with aluminum EMT.
   3. Material: Use aluminum.
   4. Connectors and Couplings: Use compression/gland or set-screw type.
      a. Do not use indenter type connectors and couplings.
   5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
   6. Embedded Within Concrete, Where Permitted: Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.14 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. ABB; Carlon: www.carlon.com/#sle.
   2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.

3. Cantex Inc: www.cantexinc.com/#sle.
4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
5. JM Eagle: www.jmeagle.com/#sle.
6. Rymco USA: www.rymcousa.com/#sle.

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.

2.15 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:
1. ABB; Carlon: www.electrification.us.abb.com/#sle.
2. Cantex Inc: www.cantexinc.com/#sle.
3. IPEX, a division of Aliaxis: ww.ipexna.com/#sle.

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA BI 50058 and listed and labeled as complying with UL 1653.

C. Fittings:
1. Manufacturer: Same as manufacturer of ENT to be connected.
2. Use solvent-welded type fittings.
3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.16 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
2. Electri-Flex Company: www.electriflex.com/#sle.
3. IPEX, a division of Aliaxis: www.ipexna.com/#sle.

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.

2.17 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch (0.51 mm).

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. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf (5.6 kN).

E. Foam Conduit Sealant:
1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Rated to hold minimum of 10 ft (3.0 m) water head pressure.
4. Products:

a. American Polywater Corporation; Polywater AFT Foam Duct Sealant: www.polywater.com/#sle.
b. American Polywater Corporation; Polywater FST Foam Duct Sealant: www.polywater.com/#sle.

F. Conduit Mechanical Seals:
1. Listed as complying with UL 514B.
2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around conductors/cables to be installed.
4. Products:
a. American Polywater Corporation; PHRD SG Mechanical Seals: www.polywater-haufftechnik.com/#sle.

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.
3. Products:
a. American Polywater Corporation; PZVR Cement-Coated Concrete Wall Sleeves: www.polywater-haufftechnik.com/#sle.
b. American Polywater Corporation; PHSD Mechanical Seals: www.polywater-haufftechnik.com/#sle.
c. American Polywater Corporation; PHSI 150 Varia Double Wall Inserts: www.polywater-haufftechnik.com/#sle.
d. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.

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. Alta Products, LLC; Sigrist Pipe Chase Housing, Curbs, and Exit Seals: www.altaproductsllc.com/#sle.
b. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
c. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.

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: www.quickflashproducts.com/#sle.

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.

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. Electrical Nonmetallic Tubing (ENT): Install in accordance with NECA 111.

I. Liquidtight Flexible Nonmetallic Conduit (LFNC): Install in accordance with NECA 111.

J. 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. 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.
   6. Arrange conduit to maintain adequate headroom, clearances, and access.
   7. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
   8. Arrange conduit to provide no more than 150 feet (46 m) between pull points.
   9. Route conduits above water and drain piping where possible.
   10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
   12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:

K. Conduit Support:
   1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.
   2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   3. 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.
   4. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
   5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
   6. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
   7. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.

8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.

L. 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.

M. 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. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
6. 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.
7. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 078400.

N. Underground Installation:
1. Provide trenching and backfilling; see Section 312316.13.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 18 inches (460 mm).
   b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
3. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 260553.

O. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch (27 mm) trade size unless otherwise approved.
2. Install conduits within middle one third of slab thickness.
3. Secure conduits to prevent floating or movement during pouring of concrete.

P. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated; see Section 033000.

Q. 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 conduits are subject to earth movement by settlement or frost.

R. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
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.

S. 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 (300 mm) at each end.

T. Provide grounding and bonding; see Section 260526.

U. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. 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

SECTION 260533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - 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 262726 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. 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. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (Reaffirmed 2020).

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

H. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

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 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; 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. See Section 013000 - Administrative Requirements, for submittal procedures.

B. 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.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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 (1,650 cu cm), 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 cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
   4. Use cast aluminum boxes where aluminum rigid metal conduit is used.
   5. Use nonmetallic boxes where exposed rigid PVC conduit is used.
   6. Use suitable concrete type boxes where flush-mounted in concrete.
   7. Use suitable masonry type boxes where flush-mounted in masonry walls.

8. Use raised covers suitable for the type of wall construction and device configuration where required.
9. Use shallow boxes where required by the type of wall construction.
10. Do not use "through-wall" boxes designed for access from both sides of wall.
11. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
12. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
13. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
14. 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.
15. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
16. 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.
17. Wall Plates: Comply with Section 262726.
18. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation; _____: www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products; _____: www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products; _____: www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Electric Co; _____: www.emerson.com/#sle.
    e. Thomas & Betts Corporation; _____: www.tnb.com/#sle.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
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:
3. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

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; _____: www.hubbell.com/#sle.

E. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
4. Manufacturer: Same as manufacturer of floor box service fittings.

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 (300 mm).
4. 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.
5. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products; _____: www.hubbellpowersystems.com/#sle.
      2) MacLean Highline; _____: www.macleanhighline.com/#sle.
      3) Oldcastle Precast, Inc; _____: www.oldcastleprecast.com/#sle.
   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.

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. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:
   1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 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 262726.
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 (150 mm) horizontal separation unless otherwise indicated.
8. 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 (610 mm) 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 (0.0103 sq m) or such that the total aggregate area of openings exceeds 100 square inches (0.0645 sq m) for any 100 square feet (9.29 sq m) of wall area.
9. 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 260533.13.
10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Within joists in areas with no ceiling.
    b. Electrical rooms.
    c. Mechanical equipment rooms.

H. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 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. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. 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 (6 mm) 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 (3 mm) at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

M. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 260526.

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

SECTION 260553 - 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 099113 - Exterior Painting.

B. Section 099123 - Interior Painting.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 262726 - 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; 2027.

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 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

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. 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. Do not identify spares and spaces.
b. Enclosed switches and circuit breakers:
   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.
c. Time Switches:
   1) Identify load(s) served and associated circuits controlled. Include location.
d. Enclosed Contactors:
   1) Identify ampere rating.
   2) Identify voltage and phase.
   3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).
   4) Identify coil voltage.
   5) Identify load(s) and associated circuits controlled. Include location.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
3. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
4. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches (76 mm) wide, painted in accordance with Section 099123 and 099113.
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.
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 (89 mm by 127 mm).
   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.

7. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

B. Identification for Conductors and Cables:
   1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
   2. 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.

C. Identification for Raceways:
   1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet (6.1 m).
   2. 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 (6.1 m).
      b. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches (76 mm) wide.
         1) Field-Painting: Comply with Section 099123 and 099113.
         2) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
      c. Color Code:
         1) Fire Alarm System: Red.
   3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
   4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
   5. Use underground warning tape to identify underground raceways.
   6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet (6.1 m).

D. Identification for Boxes:
   1. Use voltage markers to identify highest voltage present.
   2. Use voltage markers or color coded boxes to identify systems other than normal power system.
      a. Color-Coded Boxes: Field-painted in accordance with Section 099123 and 099113 per the same color code used for raceways.

E. Identification for Devices:
   1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
   2. Factory Pre-Marked Wallplates: Comply with Section 262726.
   3. Use identification label to identify fire alarm system devices.
   4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
   1. Manufacturers:
      a. Brimar Industries, Inc: www.brimar.com/#sle.
      b. Kolbi Pipe Marker Co; _____: www.kolbipipemarkers.com/#sle.
      c. Seton Identification Products; _____: www.seton.com/#sle.
   2. Materials:
      a. 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 (1.6 mm); engraved text.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
a. Brady Corporation; _____: www.bradyid.com/#sle.
b. Brother International Corporation: www.brother-usa.com/#sle.
c. Panduit Corp: www.panduit.com/#sle.
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 (25 mm) by 2.5 inches (64 mm).
2. Legend:
a. System designation where applicable:
1) 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 (25 mm).
b. Equipment Designation: 1/2 inch (13 mm).
5. Color:
a. Normal Power System: White text on black background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
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 (6 mm).
5. Color: Black text on white background unless otherwise indicated.

E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
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: 1/2 inch (13 mm).
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Power source and circuit number or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:

1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation; _____: www.bradyid.com/#sle.
2. HellermannTyton; _____: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.

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 (3 mm).

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:
1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
3. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).

E. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:

F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:
1. Brady Corporation; _____: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; _____: www.seton.com/#sle.

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

C. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).

D. Legend: Type of service, continuously repeated over full length of tape.

E. Color:
1. Tape for Buried Power Lines: Black text on red background.

2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

A. Manufacturers:
   1. Brady Corporation; _____: www.bradyid.com/#sle.
   2. Brimar Industries, Inc: www.brimar.com/#sle.
   3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
   4. Seton Identification Products; _____: www.seton.com/#sle.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches (76 mm) wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

A. Manufacturers:
   1. Brimar Industries, Inc: www.brimar.com/#sle.
   2. Clarion Safety Systems, LLC; _____: www.clarionsafety.com/#sle.
   3. Insite Solutions, LLC; _____: www.stop-painting.com/#sle.
   4. Seton Identification Products; _____: www.seton.com/#sle.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:
   1. Materials:
      a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
      b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
   2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
   3. Minimum Size: 7 by 10 inches (178 by 254 mm) 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 (51 mm by 102 mm) 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. Boxes: Outside face of cover.
   9. Conductors and Cables: Legible from the point of access.

10. 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 (75 mm) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. Outdoor photo controls.

D. Lighting contactors.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

E. Section 265100 - Interior Lighting.

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 IA 10030 - Industrial Control and Systems: Enclosures; 2024.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

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

G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

H. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

I. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

J. 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 lighting control device product selections with luminaire characteristics; see Section 265100 and lighting fixture schedule.
   5. Notify Architect of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install lighting control devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Field quality control reports.

D. 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. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for occupancy sensors.

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.

2.02 OCCUPANCY SENSORS

A. 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 (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
      b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
      c. 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. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. 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.
11. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
12. Where wired sensors are indicated, wireless sensors are acceptable provided that components and wiring modifications necessary for proper operation are included.

B. 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 low voltage units, for use with separate compatible accessory power packs.
c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
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: Color to be selected.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within area of 900 square feet (83.6 sq m).

C. 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. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
c. 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.
d. 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.
e. Finish: Color to be selected<>.
2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within area of 900 square feet (83.6 sq m).

D. 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.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet (111.5 sq m) at mounting height of 9 feet (2.7 m), with field of view of 360 degrees.

E. 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.

2.03 TIME SWITCHES

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.

2.04 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
1. Intermatic, Inc: www.intermatic.com/#sle.

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 (10.8 to 53.8 lux) 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.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

2.05 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB; _____: www.electrification.us.abb.com/#sle.
2. Eaton Corporation; _____: www.eaton.com/#sle.
3. Rockwell Automation Inc; _____: www.rockwellautomation.com/#sle.
4. Schneider Electric; _____: www.se.com/#sle.
5. Siemens Industry, Inc; _____: www.new.siemens.com/#sle.

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 the available fault current at the installed location..

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:

3. Finish: Manufacturer's standard unless otherwise indicated.

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. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 260533.16.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switch Occupancy Sensors: 48 inches (1.2 m) 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 (80 mm) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

C. Maintain separation of remote-control, signaling, and power-limited circuits.
   1. See manufacturer instructions and Section 260519 for control wiring conductors, wiring methods, and identification requirements.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate; see Section 262726.

H. Provide required supports; see Section 260529.

I. 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.

J. 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 (1.2 m) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. 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.

L. 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.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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. 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.

D. 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.

E. 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. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 262100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 260526 - Grounding and Bonding for Electrical Systems.

C. Section 260529 - Hangers and Supports for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

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. 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. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

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.

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. Division of Responsibility: Per Utility Company requirements.

D. 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 trenching and backfilling in accordance with Section 312316.13.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 033000.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 260529.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 262416 - 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 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 264300 - 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.

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. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

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 (-5 degrees C) and 104 degrees F (40 degrees C).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

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 (2,000 m).
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

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. Provide removable end walls for NEMA Type 1 enclosures.
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.
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 264300, list and label panelboards as a complete assembly including surge protective device.

L. 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.

M. Load centers are not acceptable.

N. 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: Aluminum.
2. Ground Bus Material: Aluminum.

D. Circuit Breakers:
1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

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: Aluminum.
   3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
   1. Provide surface-mounted or flush-mounted enclosures as indicated.
   2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
   3. 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.
   7. Do not use tandem circuit breakers.
   8. Do not use handle ties in lieu of multi-pole circuit breakers.
   9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
   10. Provide the following features and accessories where indicated or where required to complete installation:
      a. 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 260529.

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 (2000 mm) above the floor or working platform.

I. Provide minimum of six spare 1 inch (27 mm) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

J. Provide grounding and bonding in accordance with Section 260526.

K. Install all field-installed branch devices, components, and accessories.

L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

M. Provide filler plates to cover unused spaces in panelboards.

N. 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.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. 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.

D. Test GFCI circuit breakers to verify proper operation.

E. 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

SECTION 262726 - WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates and covers.

E. Floor box service fittings.

1.02 RELATED REQUIREMENTS

A. Section 260533.16 - Boxes for Electrical Systems.

B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

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 1472 - Solid-State Dimming 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. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

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. Wiring Device Applications:
   1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
   2. Provide GFCI protection for:
      a. Receptacles installed within 6 feet (1.8 m) of sinks.
      b. Receptacles installed in kitchens.
      c. Receptacles serving electric drinking fountains.

C. Wiring Device Finishes:
   1. Provide wiring device finishes as required by the Architect.

2.02 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

B. Wall Switches - 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: Industrial 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.

2.03 WALL DIMMERS

A. Wall Dimmers - 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.

B. Control: Slide control type with separate on/off switch.

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated; _____: www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
   3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
   4. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

B. Receptacles - 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: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
a. Products:
1) Hubbell Incorporated; EdgeConnect Series: www.hubbell.com/#sle.

D. GFCI Receptacles:
1. GFCI Receptacles - 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.
2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
a. Products:
1) Hubbell Incorporated; Model _____: www.hubbell.com/#sle.
3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

2.05 WALL PLATES AND COVERS

A. Manufacturers:
1. Hubbell Incorporated; _____: www.hubbell-wiring.com/#sle.
2. Intermatic, Inc; _____: www.intermatic.com/#sle.
3. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
4. Lutron Electronics Company, Inc; _____: www.lutron.com/#sle.
5. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.

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. 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.

2.06 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

B. Flush Floor Service Fittings:
1. Dual Service Flush Combination Outlets:
a. Cover: Rectangular.
b. Configuration:
1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2) Communications: _____.
3) Voice and Data Jacks: Provided by others.

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 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 260533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches (1200 mm) above finished floor.
      b. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) 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 (80 mm) 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 (150 mm) 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. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

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. Identify wiring devices in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

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

SECTION 262816.13 - ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

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. 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 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; 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 work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within 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 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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 circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed circuit breakers.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

D. Siemens Industry, Inc: www.new.siemens.com/#sle.

E. Source Limitations: Provide enclosed circuit breakers and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

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 (2,000 m).
   2. Ambient Temperature: Between 23 degrees F (-5 degrees C) and 104 degrees F (40 degrees C).

D. Short Circuit Current Rating:
   1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

J. 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. Outdoor Locations: Type 3R.
   2. Provide surface-mounted enclosures unless otherwise indicated.

K. Provide externally operable handle with means for locking in the OFF position.

2.03 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.

B. Interrupting Capacity:
   1. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:
   1. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. 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.

E. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

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 260529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than _____ amperes. Tests listed as optional are not required.

D. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

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 circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 262816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

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.

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 013000 - 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.

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.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB: www.electrification.us.abb.com/#sle.

B. Eaton Corporation: www.eaton.com/#sle.

C. Schneider Electric: www.se.com/#sle.

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 (2,000 m).
   2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Provide with switch blade contact position that is visible when the cover is open.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

J. 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:

K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

L. Heavy Duty Switches:
   1. Comply with NEMA BS 31047.
   2. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

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 260529.

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 (2000 mm) above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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

SECTION 264300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for distribution locations.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

1.03 ABBREVIATIONS AND ACRONYMS

A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

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

D. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1.07 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Factory-installed, Internally Mounted Surge Protective Devices:
   1. Same as manufacturer of equipment containing surge protective device, to provide complete listed assembly including SPD.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:
   1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):
   1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA EN 10250: Unless otherwise indicated, as specified for the following installation locations:

H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

2.03 SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Distribution locations include SPDs connected to distribution panelboards.

B. Surge Protective Device:
   1. Protection Circuits: Field-replaceable modular or non-modular.
   2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
   3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
   4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
   5. Diagnostics:
      a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
      b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

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. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 265100 - INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

1.03 REFERENCE STANDARDS

A. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2024.

B. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

C. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2025.

D. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

E. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 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.

H. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

I. UL 1598 - Luminaires; Current Edition, Including All Revisions.

J. 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 013000 - Administrative Requirements, for submittal procedures.

B. 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.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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 017800 - Closeout Submittals, for additional warranty requirements.

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.

H. 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 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. 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.
1. Self-Powered Exit Signs:
a. 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.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low-voltage disconnect to prevent battery damage from deep discharge.
e. 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.

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 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.

G. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Install accessories furnished with each luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. 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.

L. Exit Signs:

M. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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

A. See Section 017800 - Closeout Submittals, for closeout submittals.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 265600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - 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. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

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

G. UL 1598 - Luminaires; Current Edition, Including All Revisions.

H. 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 013000 - Administrative Requirements, for submittal procedures.

B. 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.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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 017800 - Closeout Submittals, for additional warranty requirements.

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. 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.

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 260533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 260529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

G. 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. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 033000.
         1) Install anchor bolts plumb per template furnished by pole manufacturer.
         2) Position conduits to enter pole shaft.
      b. Install foundations plumb.
      c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
      d. 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.

H. Install accessories furnished with each luminaire.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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. See Section 017800 - Closeout Submittals, for closeout submittals.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 271000 - STRUCTURED CABLING

GENERAL SCOPE OF WORK

1.01 REFERENCE STANDARDS

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

B. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e, with Addendum (2022).

C. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).

THE CONTRACTOR SHALL PROVIDE A COMPLETE AND FULLY FUNCTIONAL STRUCTURED CABLING INFRASTRUCTURE. THIS INCLUDES THE FURNISHING, ROUTING, INSTALLATION, AND TERMINATION OF ALL STRUCTURED CABLING FROM THE MAIN DISTRIBUTION FRAME (MDF) OR INTERMEDIATE DISTRIBUTION FRAME (IDF) TO THE DESIGNATED WORK AREA OUTLETS.

CODES AND STANDARDS

ALL WORK SHALL COMPLY WITH THE LATEST EDITIONS OF THE FOLLOWING STANDARDS:

ANSI/TIA-568.0-D: GENERIC TELECOMMUNICATIONS CABLING FOR CUSTOMER PREMISES

ANSI/TIA-569-E: TELECOMMUNICATIONS PATHWAYS AND SPACES

BICSI: TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL (TDMM)

NFPA 70: NATIONAL ELECTRICAL CODE (NEC)

MATERIALS

STRUCTURED CABLE: CATEGORY 6A, 4-PAIR, UNSHIELDED TWISTED PAIR (UTP), SOLID COPPER CONDUCTOR. CABLE MUST BE PLENUM-RATED (CMP) WHEN INSTALLED IN AIR-HANDLING SPACES. CABLE SHOULD BE BLUE IN COLOR.

WORK AREA TERMINATIONS: CATEGORY 6A RJ-45 KEYSTONE JACKS. JACKS MUST BE COMPATIBLE WITH THE SELECTED FACEPLATES AND FLUSH-MOUNTED. KEYSTONE JACKS SHOULD BE BLUE IN COLOR.

TELECOM ROOM TERMINATIONS: 19-INCH RACK-MOUNTABLE, 24-PORT OR 48-PORT RJ-45 PUNCH-DOWN PATCH PANELS, RATED FOR THE MATCHING CABLE CATEGORY.

SUPPORT HARDWARE: J-HOOKS, CABLE TRAYS, OR ENGINEERED SUPPORT SYSTEMS.

ROUGH-IN HARDWARE: DEEP MULTI-GANG ELECTRICAL BOXES OR LOW-VOLTAGE MUD RINGS. MINIMUM 1-INCH ELECTRICAL METALLIC TUBING (EMT) CONDUIT.

ROUGH-IN & CONDUIT REQUIREMENTS

IN-WALL PATHWAYS: ALL TELECOMMUNICATIONS CABLING ROUTED VERTICALLY WITHIN WALLS MUST BE INSTALLED INSIDE CONTINUOUS CONDUIT (E.G., EMT). FREE-AIR DROPPING OR FISHING OF CABLES DIRECTLY INSIDE WALL CAVITIES IS STRICTLY PROHIBITED.

CONDUIT SIZING AND ROUTING: CONDUIT SHALL BE A MINIMUM OF 1-INCH TRADE SIZE. THE CONDUIT MUST RUN UNBROKEN FROM THE WORK AREA BACKBOX DIRECTLY UP TO THE ACCESSIBLE CEILING SPACE ABOVE.

PROTECTION AND FUTURE-PROOFING: THE TOP END OF THE CONDUIT IN THE CEILING SPACE MUST BE FITTED WITH A PLASTIC BUSHING TO PROTECT THE CABLE JACKET FROM SHARP METAL EDGES. ALL CONDUITS, WHETHER CURRENTLY OCCUPIED OR LEFT AS SPARES, MUST INCLUDE A NYLON PULL STRING TIED OFF AT BOTH ENDS FOR FUTURE CABLE INSTALLATIONS.

BEND RADIUS: CONDUIT RUNS SHALL NOT EXCEED TWO 90-DEGREE BENDS WITHOUT THE INSTALLATION OF A PROPERLY SIZED PULL BOX.

INSTALLATION REQUIREMENTS

CEILING PATHWAYS: ONCE EXITING THE IN-WALL CONDUIT INTO THE CEILING SPACE, ALL CABLING SHALL BE RUN NEATLY AND PARALLEL/PERPENDICULAR TO BUILDING STRUCTURE LINES. CABLES MUST BE SUPPORTED A MAXIMUM OF EVERY 4 TO 5 FEET USING DEDICATED SUPPORT HARDWARE (E.G.,

J-HOOKS OR CABLE TRAY).

PROHIBITED PRACTICES: CABLES SHALL NOT BE LAID DIRECTLY ON DROP-CEILING GRIDS, TAPED TO DUCTWORK, OR ATTACHED TO FIRE SPRINKLER PIPES, PLUMBING, OR ELECTRICAL CONDUITS.

SEPARATION FROM INTERFERENCE: CABLES MUST MAINTAIN A MINIMUM CLEARANCE OF 12 INCHES FROM FLUORESCENT LIGHTING FIXTURES AND UNSHIELDED POWER LINES, AND 36 INCHES FROM ELECTRICAL PANELS AND LARGE MOTORS TO PREVENT ELECTROMAGNETIC INTERFERENCE (EMI).

LENGTH LIMITS: NO SINGLE HORIZONTAL CABLE RUN SHALL EXCEED 90 METERS (295 FEET) FROM THE PATCH PANEL TO THE WORK AREA KEYSTONE JACK.

TERMINATION AND WIRING

WIRING SCHEME: ALL TERMINATIONS AT BOTH THE WORK AREA AND THE PATCH PANEL SHALL FOLLOW THE T568B WIRING STANDARD.

WORK AREA (USER SIDE): EVERY CABLE SHALL BE TERMINATED INTO AN RJ-45 KEYSTONE JACK. MALE RJ-45 MODULAR PLUGS (CRIMPED ENDS) PROTRUDING FROM THE WALL ARE STRICTLY PROHIBITED. KEYSTONES SHALL BE SECURELY SNAPPED INTO WALL FACEPLATES, SURFACE-MOUNT BOXES, OR FLOOR BOXES.

TELECOM ROOM (RACK SIDE): EVERY CABLE SHALL BE ROUTED TO THE DESIGNATED MDF/IDF AND PERMANENTLY PUNCHED DOWN INTO THE BACK OF A RACK-MOUNTED PATCH PANEL. MALE RJ-45 MODULAR PLUGS DIRECTLY CONNECTING TO NETWORK SWITCHES ARE STRICTLY PROHIBITED.

SERVICE LOOPS: A MINIMUM 10-FOOT SERVICE LOOP SHALL BE LEFT IN THE CEILING ABOVE THE MDF/IDF, AND A MINIMUM 3-FOOT SERVICE LOOP SHALL BE LEFT IN THE CEILING SPACE DIRECTLY ABOVE THE CONDUIT DROP FOR EACH WORK AREA OUTLET TO ACCOMMODATE FUTURE MOVES OR RE-TERMINATIONS.

TESTING AND LABELING

LABELING: BOTH ENDS OF EVERY CABLE MUST BE CLEARLY LABELED WITH A MACHINE-GENERATED, WRAP-AROUND LABEL. THE LABEL MUST IDENTIFY THE TELECOM ROOM, PATCH PANEL, AND SPECIFIC PORT NUMBER (E.G., MDF-PANELA-PORT01). CORRESPONDING LABELS MUST BE PLACED ON THE WALL FACEPLATE AND THE PATCH PANEL PORT.

CERTIFICATION: EVERY TERMINATED LINK MUST BE TESTED AND CERTIFIED USING A LEVEL III (OR HIGHER) CABLE CERTIFIER (E.G., FLUKE NETWORKS DSX SERIES) TO VERIFY COMPLIANCE WITH THE SPECIFIED CATEGORY STANDARDS. THE CONTRACTOR SHALL PROVIDE A FULL PDF EXPORT OF THE TEST RESULTS TO THE OWNER PRIOR TO PROJECT SIGN-OFF.

END OF SECTION

SECTION 284600 - 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 260533.16 - Boxes for Electrical Systems.

B. Section 271000 - Structured Cabling: Data cables for fire alarm system IP network connections.

1.03 ABBREVIATIONS AND ACRONYMS

A. AHJ: Authorities having jurisdiction.

B. BAS: Building automation system.

C. DMNS: Distributed mass notification system.

D. ECS: Emergency communications system.

E. EoL: End-of-line.

F. EVACS: Emergency voice/audio communication systems.

G. FACU: Fire alarm control unit.

H. HVAC: Heating, ventilation, and air conditioning.

I. IDC: Initiating device circuit.

J. LAN: Local area network.

K. MNS: Mass notification system.

L. NAC: Notification appliance circuit.

M. NPLFA: Non-power-limited fire alarm.

N. PLFA: Power-limited fire alarm.

O. SLC: Signaling line circuit.

P. SOO: Sequence of operation.

1.04 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. ICC (IFC) - International Fire Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

E. NECA 305 - Standard for Fire Alarm System Job Practices; 2018.

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

G. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2027.

I. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

K. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

L. UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

M. UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

N. UL 497B - Standard for Protectors for Data Communications and Fire-Alarm Circuits; Current Edition, Including All Revisions.

O. UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

P. UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

Q. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

R. UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

S. UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of equipment with dimensions and clearance requirements of actual equipment.
   2. Coordinate placement of devices and notification appliances with potential conflicts or view obstructions.
   3. Coordinate work to provide power for equipment at required locations (e.g., smoke dampers, type of actuators, line or local control transformer, zoning, grouping and circuit activations).
   4. Coordinate requirements for branch circuit protection, identification, and shunt trip if applicable.
   5. Coordinate reflected ceiling plans to avoid conflicting placements; maintain minimum diffuser and detector clearances as indicated.
   6. Coordinate submittals to confirm equipment and associated components are capable of indicated settings, and manufacturer documentation identifies required compatible product listings.
   7. Notify Architect of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Verify exact termination locations required for boxes, enclosures, and equipment.
   2. Do not install devices or notification appliances until final surface finishes, painting, and cleaning are complete, unless otherwise required by AHJ.
   3. Do not begin installation of conductors and cables until installation of conduit and pathways between termination points is complete.
   4. Sequence work to protect cabling (e.g., overspray painting, physical stress, and insulation damage or covering markings).
   5. Verify naming convention for equipment identification, including room names and numbers, prior to creation of final drawings, reports, and labels.

1.06 SUBMITTALS

A. See Section 013000 - 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.

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.

1.07 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.

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.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NECA 305.

C. Handle carefully to avoid damage to internal components, enclosure, and finish.

D. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.09 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

B. Do not exceed maximum ambient temperature requirements for batteries at any time, which reduces battery service life. Replace batteries exposed to temperatures in excess of manufacturer's requirements.

C. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (minus 10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

1.10 WARRANTY

A. Fire Alarm Control Units and Accessory Equipment: Provide minimum 3-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B. Fire Alarm Manual Pull Stations: Provide minimum 1-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

C. Fire Alarm System Detectors: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

D. Fire Alarm System Notification Appliances: Provide minimum 1-year year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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. Fire Alarm System Design Information:
      a. Building Code: Comply with applicable building code.
         1) Principle Occupancy: As indicated on Architect code summary drawings.
         2) Principle Use: As indicated on Architect code summary drawings.
      b. NFPA 72 Fire Alarm System Classification: Remote supervising station.
   5. 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.

6. 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).
c. Pathway Survivability:
1) Unless otherwise indicated or required, pathways to meet requirements for Pathway Survivability Level 0 (nonrated cable, no required provisions for pathway survivability).
7. Spare System Capacity:
a. SLCs: Minimum 25 percent spare capacity.
b. NACs: Minimum 25 percent spare capacity.
8. Secondary Power Source - Battery Storage Capacity:
a. Provide standby (nonalarm) operation sufficient for 24 hours.
b. Provide additional alarm operation for 15 minutes.
c. Calculate combined of standby load plus alarm load for overall battery storage capacity requirements, per power supply.
d. Provide 25 percent additional overall battery capacity correction factor.

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.
5. Other Interconnected Systems: For systems listed below, provide minimum of two monitoring point inputs each.
    a. Gas Detection Systems: Including providing notification appliances as indicated on plans for CO - Carbon Monoxide.

2.02 FIRE ALARM CONTROL UNITS AND RELATED EQUIPMENT

A. Manufacturers:
1. Honeywell International, Inc; Honeywell Gamewell-FCI: www.honeywell.com/#sle.
2. Honeywell International, Inc; Honeywell Notifier: www.honeywell.com/#sle.
3. NAPCO Security Technologies, Inc: www.napcosecurity.com/#sle.
4. Potter Electric Signal Company: www.pottersignal.com/#sle.
5. Siemens Industry: www.siemens.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.
7. Source Limitations: Furnish FACUs and related equipment produced by single manufacturer and obtained from single supplier.

B. Fire Alarm Control Units and Related Equipment: Listed and labeled as complying with UL 864.

C. Provide cabinets and enclosures as indicated or as required to house system components.

D. Fire Alarm Control Unit (FACU): Addressable.
1. SLCs and IDCs: Configurable for Class B or Class A with additional modules.
2. NACs: Integral and programmable with synchronization modules or cards as required.
3. Power Supply: 120 VAC, 60 Hz, supplying necessary power for FACU.
4. User-Interface: Touchscreen display for system interfacing and service mode settings, include password and user credentials; configurable for custom actions and incorporates historical event log.
5. Support self-testing detector capability.
6. Remote Annunciator Support: Up to 10.
7. Provide NAC expansion as required.

E. Notification Appliance Circuit Expansion:
1. Where notification appliance circuit requirements exceed capacity of FACU, provide accessories and cabinets as required for expansion.

F. Addressable Interface Modules:
1. General Requirements:
    a. Provide addressable modules suitable for connection to FACU SLCs.
    b. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
2. Addressable Monitor Modules: Unless devices are explicitly permitted connected together on one zone; provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable FACU.
3. Addressable Relay Modules:
    a. Provide as indicated or as required to perform necessary functions via dry-contact interface.
    b. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
4. Addressable SLC Isolating Modules:

a. Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally.
b. Provide automatic reset upon correction of short circuit.

G. Alarm Communication:
1. Protected Premises Alarm and Signaling Systems:
a. Provide accessories as required for interface as indicated and as required by AHJ.
b. Provide accessories in accordance with building code, fire code, and life safety code requirements for occupancy classifications and use cases.
c. Include software and firmware control, required features, special requirements for low-power radio (wireless) systems, and fire alarm system interconnections required by NFPA 72.
2. Supervising Station Alarm Systems:
a. Provide accessories as required for interface with supervising station as indicated and as required by AHJ.
b. Communication Method: Dual path, internet protocol (IP) primary with cellular backup.
c. Supervise communication paths at interval required by NFPA 72.
3. Products:
a. NAPCO Security Technologies, Inc; StarLink Max Series Cellular Communicators: www.napcosecurity.com/#sle.

H. Remote Annunciators:
1. LCD Remote Annunciators:
a. Provide backlit LCD display that mimics FACU display.
b. Provide dedicated status indications for power and alarm, supervisory, and trouble conditions.
c. Enable system control functions including acknowledge, silence, and reset.
d. Provide local audible alarm.
e. Mounting: Wall-mounted; provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2.03 FIRE ALARM SYSTEM INITIATING DEVICES

A. Manufacturers:
1. Honeywell International, Inc; Honeywell Gamewell-FCI: www.honeywell.com/#sle.
2. Honeywell International, Inc; Honeywell Notifier: www.honeywell.com/#sle.
3. NAPCO Security Technologies, Inc: www.napcosecurity.com/#sle.
4. Siemens Industry: www.siemens.com/#sle.
5. Source Limitations: Furnish initiating devices produced by same manufacturer as FACUs where possible.

B. General Requirements:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable FACU; suitable for connection to FACU SLCs.
b. Conventional/Nonaddressable Devices: Provide addressable interface modules as indicated or as required for connection to addressable FACU. Unless devices are explicitly permitted to be connected together as one zone, provide separate addressable monitoring point for each device in order to be individually identifiable by addressable FACU.
2. Provide devices and associated accessories suitable for intended application and location to be installed. Unless otherwise indicated, use addressable devices and addressable interface modules only in clean, dry, indoor, nonhazardous locations.
3. Surface-Mounted Devices: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.

4. Devices for Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
5. Devices for Hazardous/Classified Locations: Listed and labeled as suitable for classification of installed location.

C. Manual Fire Alarm Boxes/Pull Stations:
1. Description: Noncoded manual signaling boxes listed and labeled as complying with UL 38.
2. Alarm Initiation: Configured for general alarm initiation unless otherwise indicated; presignal stations (where indicated) require use of key to initiate general alarm.
3. Operation: Dual-action unless otherwise indicated or required.
a. Dual-Action Operation: First requires pushing, pulling, or lifting, then pulling of lever.
4. Color: Red, in accordance with NFPA 72.
5. Station Reset: Requires use of key or tool.

D. Spot-Type Detectors:
1. Utilize plug-in mounting to separate base with tamper-resistant feature; provide bases as indicated or as required.
2. Addressable Detectors:
a. Provide LED indication of normal operation and regular communication with FACU and alarm condition.
b. Provide reporting of analog sensor values to FACU.
3. Smoke Detectors:
a. Listed and labeled as complying with UL 268.
b. Provide sensor type (e.g., photoelectric, ionization) as indicated.
c. Provide automatic drift compensation.
4. Thermal/Heat Detectors:
a. Listed and labeled as complying with UL 521.
b. Provide sensor type (e.g., fixed temperature, rate-of-rise) and rating as indicated.
5. Carbon Monoxide Detectors:
a. Listed and labeled as complying with UL 2075.
b. Provide end-of-life notification.

E. Duct Smoke Detectors:
1. Listed and labeled as complying with UL 268A.
2. Ratings: Compatible with air velocity, temperature, and humidity requirements for installed duct.
3. Housing: Select as required for application.
4. Sampling Tubes: Select as required for installation in duct to be monitored.

F. Accessories:
1. Remote Test Stations: Allows for detector key switch test and reset; provides visual and audible indication of alarm condition.
2. Remote Indicators: Provides visual indication of alarm condition.
3. Provide Detector Bases As Indicated:
a. Color: White, unless otherwise indicated.
b. Relay bases.
c. Isolator bases.
4. Provide power supervision relays as required.

2.04 FIRE ALARM SYSTEM NOTIFICATION APPLIANCES

A. Manufacturers:
1. Honeywell International, Inc; Honeywell System Sensor: www.honeywell.com/#sle.
2. Siemens Industry; ACEND: www.siemens.com/#sle.

3. Source Limitations: Furnish notification appliances produced by same manufacturer as FACUs where possible.

B. General Requirements:
   1. Provide signaling notification appliances listed for fire-protective service and intended operating mode, public or private; suitable for connection to FACU notification appliance circuits.
   2. Provide notification appliances and associated accessories suitable for intended application and location to be installed. Use notification appliances only according to listed mounting (e.g. ceiling, wall).
   3. Surface-Mounted Notification Appliances: Provide manufacturer's accessory surface mount backboxes or suitable outlet/device box.
   4. Exterior Notification:
      a. In addition to required occupant notification, provide notification appliances on exterior of building.
      b. Outdoor and Damp/Wet Locations: Weatherproof, suitable for outdoor use; provide manufacturer's accessory backboxes or enclosures in accordance with product listing.
      c. Visible Notification: Provide strobe beacon with red lens; interface to dedicated NAC or addressable control module, 24 VDC, supervised.
   5. Notification Appliance Derating: Include device derating adjustments in accordance with listing where applicable, including the following.
      a. Where accessory protective guards or enclosures are utilized.
      b. Where required by field conditions (e.g., ambient temperature and sound).
   6. Notification Appliance Color:
      a. Wall-Mounted: Red.
      b. Ceiling-Mounted: White.
      c. See drawings for mounting configuration indicated by symbols on floor plans, system interconnection diagrams, and details.

C. Visible Notification Appliances:
   1. Public Mode Operation: Listed and labeled as complying with UL 1971.
   2. Strobes: Clear or nominal white lens with flash rate of 1 Hz unless otherwise indicated or required; xenon or LED light source with maximum pulse duration of 0.02 seconds; candela rating as indicated.
      a. Where field-selectable candela strobes are specified, substitution of fixed candela strobes is not permitted.

D. Audible Notification Appliances:
   1. Listed and labeled as complying with UL 464.
   2. Rated Sound Pressure Level: As required to achieve design sound pressure levels, but not less than 75 dBA at 10 feet (3.1 m) for public mode operation or 45 dBA at 10 feet (3.1 m) for private mode operation in accordance with UL 464.
   3. Horns: Selectable tone, including at minimum NFPA 72 temporal 3 pattern and continuous; minimum of two selectable volume levels.

E. Combination Notification Appliances: Comply with respective requirements for each signaling method.

F. Accessories:
   1. Notification Appliance Bases: White, unless otherwise indicated.
   2. Provide guards to protect notification appliances where subject to mechanical damage; listed for use with notification appliance.

G. Products:
   1. Siemens Industry; ACEND Series Horn/Strobe: www.siemens.com/#sle.

2.05 WIRE AND CABLE

A. General Requirements:
   1. Comply with NFPA 70 listing and marking requirements for cables.
   2. Substitution of fire alarm listed cables for communication wiring, in accordance with NFPA 70, is not permitted.
   3. Provide cables as indicated or as required for connections between system components.
      a. Data Cables for IP Network Connections: Unshielded twisted pair (UTP) complying manufacturer's minimum requirements.
      b. See Section 271000.

B. Power-Limited Fire Alarm Cables (PLFA):
   1. Comply with applications of listed cables in accordance with Chapter 7 of NFPA 70.
      a. Fire alarm cable substitutions in accordance with NFPA 70: Permitted.

C. Non-Power-Limited Fire Alarm Cables (NPLFA):
   1. Comply with NPLFA circuit conductor properties in accordance with NFPA 72.
   2. Comply with listing requirements in Chapter 7 of NFPA 70.

2.06 ACCESSORIES

A. Provide components as indicated or as required for connection of fire alarm system to devices and other systems indicated.

B. Provide EoL resistors as required for wiring supervision.

C. Terminal Cabinets:
   1. Cabinet: Steel, with red finish; keyed to match fire alarm system equipment.
   2. Terminal Strips: Rated for 20 A at 250 VAC.
   3. Termination Points: Rated for 12 AWG conductors; quantity as indicated on drawings or as required for application with minimum 25 percent spare capacity.
   4. Products:

D. Protective Covers for Fire Alarm Devices:
   1. Listed to same standard as device being protected.
   2. Outdoor Covers: Weather resistant, suitable for outdoor use; use only with outdoor-rated devices.
   3. Provide guards to protect devices where subject to mechanical damage; listed for use with detector.
      a. Protective Covers for Manual Pull Stations:
         1) Provide protective covers with hinged access for manual pull stations.
         2) Listed and labeled as complying with UL 38.
      b. Protective Covers for Detectors:
         1) Use only with specific devices approved under listing.

E. Documentation Cabinets:
   1. Provide cabinets, size as indicated or as required to comply with on-site documentation storage required by NFPA 72.
      a. Quantity of Cabinets: One.
   2. Cabinet: Steel with red finish; keyed to match fire alarm system equipment unless otherwise required by AHJ.
      a. Cabinet Dimensions: Manufacturer's standard.
   3. Products:
      a. Space Age Electronics; ACERBOX: www.1sae.com/#sle.

F. Surge Protection:
   1. Line Voltage Surge Protection:
      a. Provide for each line voltage circuit serving fire alarm system control units and related equipment (e.g., FACU, field booster panels, nodes, and transponders).
      b. Listed and labeled as complying with UL 1449.

c. Products:
1) Space Age Electronics; Eclips E Series: www.1sae.com/#sle.

2. Low Voltage Surge Protection:
a. Provide for each power-limited fire alarm circuit that enters or exits a building.
b. Listed as complying with UL 497B.
c. Provide voltage/current ratings suitable for circuit to be protected.
d. Products:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements, including future system expansion as indicated on Contract Documents.

B. Verify that system capacities listed in manufacturer instructions align with designed system.

C. Verify that mounting surfaces are ready to accept components and equipment, with suitable support frames and anchors installed where required.

D. Verify ratings, configurations, and characteristics of system components.

E. Verify rough-ins for field connections.

F. Verify that work likely to damage fire alarm system has been completed.

G. Verify that interior of building has been protected from weather.

H. Perform preinstallation tests and inspections per manufacturer's instructions and in accordance with NECA 305.

I. Verify that system bonding is in accordance with Section 260526.

J. Do not energize system until deficiencies have been corrected.

K. Verify that branch circuit wiring installation is completed, tested, and ready for connection to fire alarm system. Overcurrent protection ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

3.02 PREPARATION

A. Prior to installation, confirm environment of installation area is clean, and with ambient temperature, humidity, and ventilation requirements are per manufacturer’s written instructions.
1. Clean and vacuum in accordance with manufacturer's written instructions. Confirm equipment ventilation holes are absent of obstructions and free for air flow.
2. Clean pathways thoroughly to remove foreign materials before installing conductors and cables.
3. Clean dirt, debris, plaster, and other foreign materials from equipment enclosures, cabinets, and outlet boxes.
4. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Follow tool requirements for installation, including torquing adjustments, as listed in manufacturer documentation.

C. Remove detector dust covers prior to system energization.

3.03 INSTALLATION

A. Install field-devices, components, FACU and related equipment, and accessories in accordance with the following:
1. Manufacturer's instructions, applicable codes, and Contract Documents.
2. NECA 1.
3. NECA 305.
4. NFPA 72.
5. NFPA 70; including requirements for mechanical execution of work.

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.
   a. See Section 260533.16.
2. Secure and support raceways at intervals complying with NFPA 70. Provide supports where vertical rise exceeds permissible limits.
   a. Minimum conduit size: 3/4".
   b. See Section 260529.
3. Provide minimum of 2 spare 1-inch (27 mm) trade size conduits out of each fire alarm panel stubbed into accessible space above ceiling.
4. Install firestopping to preserve fire resistance rating of partitions and other elements.
   a. Minimum height for pathways to pass through floor or wall, if cable fastening is required, in accordance with NFPA 70.
   b. See Section 078400.

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 260526.
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. Neatly train and bundle conductors inside boxes, wireways, and cabinets.
9. 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 260553.
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. Confirm integrated fire protection and life safety system tests are in accordance with:
   a. Fire Code: ICC (IFC).
   b. Life Safety Code: NFPA 101.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide services of manufacturer's authorized representation to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's detailed testing procedures and field reports and with submittals.

C. Provide equipment, two-way radios for testing personnel use, tools, and supplies required to accomplish inspection and testing.

D. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

E. Inspect and test in accordance with manufacturer's instructions.

F. Inspect wiring and components for damage and defects.

G. Batteries and Power Supplies: Perform inspections and tests listed in manufacturer installation instructions.

H. Perform additional requirements related to testing and inspection during system startup.

I. Test for interface with other systems.

J. Test shunt trips to verify operation.

K. Correct defective work, adjust for operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicated inspection and testing results, corrective actions taken, and as-found and final adjusted settings.

3.05 SYSTEM STARTUP

A. Obtain Owner approval prior to performing system startup.

B. Manufacturer Services: Provide services of manufacturer's authorized representation to systems startup. Include manufacturer's detailed startup procedures with submittals.

C. Prepare and start equipment and systems in accordance with manufacturer's instructions and recommendations.

3.06 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust initiating device and notification appliance settings to achieve desired operation as indicated in submittals.

C. Measure power supply primary and secondary voltages, log values for records, and make appropriate adjustments.

D. Adjust alignment of equipment covers and doors. Provide keys and spare keys to Owner.

E. Reprint and reinstall damaged or misinstalled labels; maintain neat and square to installed location good workmanship - see NECA 1; maintain consistent placements for identification on products of similar type.

F. Adjust devices or notification appliances and associated bases to be flush and level.

G. Program system parameters according to requirements of Owner.

3.07 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. See Section 017419 - Construction Waste Management and Disposal for field-generated construction waste requirements.

C. Check tightness of electrical connections. Replace damaged components and provide closure plates for vacant positions. Provide circuit directory updates for related power branch circuits.

D. Clean and repair existing materials and equipment that remain or are indicated for reuse.

E. Clean dirt, debris, plaster, and other foreign materials from outlet boxes and fire alarm system equipment and components.

F. Clean fire alarm system equipment and components according to manufacturer's instructions and NECA 305.

G. Clean surfaces and interiors of boxes and device cover plates in accordance with manufacturer's instructions to remove dirt, fingerprints, debris, plaster, and other foreign materials.

H. Repair scratched or marred exposed surfaces to match original factory finish.

I. Comply with federal (EPA), state, and local regulations for battery handling and disposal. Do not spill battery fluids down plumbing drains. Only use containers safe for transportation marked 'nonspillable.'

3.08 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.

3.09 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for additional submittals.

B. See Section 017900 - 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. Approved operating and maintenance data has been delivered.
   2. Spare parts, extra materials, and tools have been delivered.
   3. All aspects of operation have been demonstrated to Owner.
   4. Final acceptance of fire alarm system has been given by AHJ.

3.10 PROTECTION

A. Protect installed fire alarm system from subsequent construction operations.

3.11 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide to Owner as alternate to base bid separate maintenance contract for service and maintenance of fire alarm system for entire warranty period to include work described below; include complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with detailed schedule.

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

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for temporary erosion- and sedimentation-control measures.

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

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.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

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. Improvements on Adjoining Property: Authority for performing site clearing 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 Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises, coordinate with owner for location verification.

D. Utility Locator Service: Notify One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and tree and plant-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

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 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections.

3.5 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 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of offsite.

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.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

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.

B. 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. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 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.

3.8 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.

3.9 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. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. 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 311000

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade walks pavements and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:

1. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
2. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
3. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.2 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.

1. 24 inches outside of concrete forms other than at footings.
2. 12 inches outside of concrete forms at footings.
3. 6 inches outside of minimum required dimensions of concrete cast against grade.
4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
5. 6 inches beneath bottom of concrete slabs-on-grade.
6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. 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 Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit price.
2. Bulk Excavation: Excavation more than 10 feet in width and more 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, will be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock:

1. Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. Yd for bulk excavation or 3/4 cu. yd. for footing, trench, and pit 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:

a. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
b. 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.

2. 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 D1586.

I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other fabricated stationary features constructed above or below the ground surface.

J. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

K. 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.

L. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:

1. Geotextiles.
2. Controlled low-strength material, including design mixture.
3. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:

1. Geotextile: 12 by 12 inches.
2. Warning Tape: 12 inches long; of each color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D1557.

C. Preexcavation Photographs or Videotape: 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. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

C. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

D. 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.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups SC,CL, or GC according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: Less than 50

C. Unsatisfactory Soils: Soil Classification Groups ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2. Liquid Limit Greater than 50.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch (37.5-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

H. Drainage Course: Narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and zero to 5 percent passing a No. 8 (2.36-mm) sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and zero to 5 percent passing a No. 4 (4.75-mm) sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability:

a. Class 2; AASHTO M 288.
b. As follows:

1) Grab Tensile Strength: 157 lbf (700 N); ASTM D4632.
2) Sewn Seam Strength: 142 lbf (630 N); ASTM D4632.
3) Tear Strength: 56 lbf (250 N); ASTM D4533.
4) Puncture Strength: 56 lbf (250 N); ASTM D4833.

c. Apparent Opening Size: No.40 (0.425-mm) sieve, maximum; ASTM D4751.
d. Permittivity: 0.70 per second, minimum; ASTM D4491.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

A. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150/C150M, Type II.
2. Fly Ash: ASTM C618, Class C or F.
3. Normal-Weight Aggregate: ASTMC33/C33M, 3/4-inch (19-mm) nominal maximum aggregate size.
4. Water: ASTM C94/C94M.
5. Air-Entraining Admixture: ASTM C260/C260M.

B. Produce cellular, low-density, controlled low-strength material with the following physical properties:

C. Produce conventional-weight, controlled low-strength material with 150-psi (550-kPa) compressive strength when tested according to ASTM C495/C495M.

2.4 ACCESSORIES

Retain one or both of "Warning Tape" and "Detectable Warning Tape" paragraphs in this article to suit Project. Use of warning tapes may be mandatory for underground hazardous utilities.

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 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.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. 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.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives:

1. Do not use explosives.

3.4 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.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:

    a. 24 inches (600 mm) outside of concrete forms other than at footings.
    b. 12 inches (300 mm) outside of concrete forms at footings.
    c. 6 inches (150 mm) outside of minimum required dimensions of concrete cast against grade.
    d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
    e. 6 inches (150 mm) beneath bottom of concrete slabs-on-grade.
    f. 6 inches (150 mm) beneath pipe in trenches and the greater of 24 inches (600 mm) wider than pipe or 42 inches (1065 mm) wide.

3.5 EXCAVATION FOR STRUCTURES

Revise tolerances in this article to suit office practice if applicable.

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch (25 mm). If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

    1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

    1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, 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. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

    1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches (300 mm) higher than top of pipe or conduit unless otherwise indicated.

Revise "Clearance" Subparagraph below to suit Project.

1. Clearance: 12 inches (300 mm) each side of pipe or conduit.

C. Trench Bottoms:

Retain one of first two subparagraphs below. Retain first subparagraph if a bedding course is not required under pipe and conduit; retain second subparagraph if a bedding course is required. Revise to suit Project conditions, requirements of authorities having jurisdiction, type of pipe or conduit, and manufacturer's installation requirements.

1. Excavate trenches 4 inches (100 mm) deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

    a. Excavate trenches 6 inches (150 mm) deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches 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 smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

Revise locations for proof-rolling in first paragraph below if required; revise type of vehicle and minimum weight to suit Project. Proof-rolling can be used for wide areas, not trenches.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction. Limit vehicle speed to 3 mph (5 km/h).

2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory 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.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches (450 mm) of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch- (100-mm-) thick, concrete-base slab support for piping or conduit less than 30 inches (750 mm) below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches (100 mm) > of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch (25 mm) in any dimension, to a height of 12 inches (300 mm) over the pipe or conduit.

    a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Warning Tape: Install warning tape directly 12 inches (300 mm) above utilities.

3.13 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.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.

5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

Revise percentages in this article according to geotechnical engineer's written recommendations.

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 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 3 percent and is too wet to compact to specified density

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

Revise depth of layers in first paragraph below to suit Project.

A. Place backfill and fill soil materials in layers not more than 8 inches (200 mm) in loose depth for material compacted by heavy compaction equipment and not more than 4 inches (100 mm) 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.

Retain one option in paragraph below based on ASTM laboratory-test method required. Replace the term "unit weight" with "density" if preferred.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557

Retain applicable subparagraphs below. Percentages of maximum dry unit weight are examples only; revise to suit Project. Delete scarifying and recompacting existing subgrade when proof-rolling will suffice.

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches (300 mm) of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 95 percent.
3. Under turf or unpaved areas, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

3.16 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.

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. Unpaved Areas: Plus or minus 1 inch (25 mm).
2. Walks: Plus or minus 1 inch (25 mm).
3. Pavements: Plus or minus 1/2 inch (13 mm).

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch (13 mm) when tested with a 10-foot (3-m) straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch (150-mm) course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches (300 mm) of filter material, placed in compacted layers 6 inches (150 mm) thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum density according to ASTM D698] with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches (300 mm) of final subgrade, in compacted layers 6 inches (150 mm) thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches (150 mm).

1. Compact each filter material layer to 85 percent of maximum density according to ASTM D698 with a minimum of two passes of a plate-type vibratory compactor.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Place subbase course and base course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.

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2. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum density according to ASTM D1557.

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than **95** percent of maximum density according to ASTM D698.

3.20 FIELD QUALITY CONTROL

Retain "Special Inspections" Paragraph below if special inspections are required by code and revise to suit requirements of authorities having jurisdiction. Special inspection may not be necessary for fill less than 12 inches (305 mm) deep or outside of foundation or pavement limits; verify with building code and authorities having jurisdiction.

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

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. (186 sq. m) or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet (30 m) or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet (46 m) or less of trench length but no fewer than two tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 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 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.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes soil treatment with termiticide.

1. Treat soil under building slabs, foundations and building foundation perimeters.

1.2 SUBMITTALS

A. Product Data: For termiticide.

1. Include the EPA-Registered Label for termiticide products.
2. Product Certificates: For termite control products, signed by product manufacturer.

B. Qualification Data: For Installer of termite control products.

C. Warranty: Special warranty specified in this Section.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.

B. Source Limitations: Obtain termite control products through one source.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

1.5 COORDINATION

A. Coordinate and schedule soil treatment application with excavating, filling, grading, and concreting operations.

1. Do not schedule and perform applications when students are or expected to be on campus, and within-8-hours after application.

B. Coordinate termiticide application, such that subsequent work will promptly follow, without exposure of the termiticide application to inclement weather and other conditions that will disturb and void effectiveness of termiticide application. Should there be failure to schedule application to avoid inclement weather, or inadvertent delay by the Contractor to promptly follow with subsequent work covering and protecting the termiticide application resulting in the exposure and nulling of the termiticide application, re-application costs would be chargeable to the Contractor.

C. Allow termiticide applicator to treat soil under footings, grade beams, and ground-supported slabs before proceeding with subsequent construction.

1.6 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor on Certificate Form issued by the State of Louisiana, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation.
   1. Warranty Period: Five years from date of Substantial Completion.

B. Renewable Option: At the end of the guaranty period, offer the Owner a renewable guaranty on a year-to-year basis, at the Owner's option, at an agreed upon annual fee.

PART 2 - PRODUCTS

2.1 TERMITICIDE

A. Termiticide Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   1. Termidor SC.
   2. Premise 75.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Contractor shall perform earthmoving operations, and prepare areas ready to receive termiticide.

B. Contractor shall coordinate with Owner’s Applicator to examine substrates, areas, and conditions for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

C. Contractor shall make corrections to unsatisfactory conditions for Owner’s Applicator to apply termiticide.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level

soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 TERMITICIDE APPLICATION

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, piers, and chimney bases; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Provide trench and rodding around building perimeter. Make trenches 6-inches wide x 6-inces deep, and rods 12-inches on centers. Apply at rate of 4 gal. per linear foot of trench and per linear foot depth of holes, unless noted otherwise by manufacturer..

C. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

D. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

E. Post warning signs in areas of application.

F. Notify and recall Owner’s Applicator to reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.5 POST TREATMENT

A. One year after substantial completion of the project, applicator shall return to the project site to re-treat the project.

END OF SECTION 31 31 16

SECTION 321216 - ASPHALT PAVING

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. Hot-mix asphalt paving.
2. Hot-mix asphalt overlay.
3. Hot-mix asphalt patching.
4. Asphalt traffic-calming devices.
5. Asphalt surface treatments.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for demolition and removal of existing asphalt pavement.
2. Section 312000 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
3. Section 321313 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
4. Section 321373 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
5. Section 321400 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.
6. Section 321723 “Paving Markings” for paint and thermoplastic pavement marking.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 “ Unit Prices.”

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data, and tested physical and performance properties.

2. Geotextile.
3. Joint sealant.
4. Job-Mix Designs: For each job mix proposed for the Work.

B. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:

1. Geotextile: 12 by 12 inches (300 by 300 mm) minimum.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

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B. Material Certificates: For each paving material, signed by manufacturers. Include statement that mixes containing recycled materials will perform equal to mixes produced from all new materials.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified in accordance with ASTM D3666 for testing indicated, as documented according to ASTM E 548.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:

1. Prime Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
2. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
3. Slurry Coat: Comply with weather limitations in ASTM D3910.
4. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
5. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured.

C. Fine Aggregate: ASTM D1073, sharp-edged natural sand or sand prepared from stone, gravel, or combinations thereof.

1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 binder designation PG 64-22.

B. Asphalt Cement: ASTM D3381 for viscosity-graded material ASTM D946 for penetration-graded material.

C. Tack Coat: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

D. Fog Seal: ASTM D977 emulsified asphalt, or ASTM D2397 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

E. Water: Potable.

F. Undersealing Asphalt: ASTM D3141/D3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled **tires**, **asphalt shingles** from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D1073, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Wheel Stops: Precast, air-entrained concrete, 3,000-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel, 3/4-inch diameter, 12-inch minimum length.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 10 percent or more than 30 percent by weight

1. Surface Course Limit: Recycled content no more than 12 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: Per State DOT Specifications
3. Binder Course: Per State DOT Specifications
4. Surface Course: Per State DOT Specifications

C. Emulsified-Asphalt Slurry: ASTM D3910
1. Type 1: seal cracks, fill voids and correct surface erosion conditions
   a. Residual asphalt content: 10-16% weight of dry aggregate
   b. Application rate: 6-10 lbs/sy
2. Type 2: fill surface voids, correct severe surface erosion conditions and provide minimum wearing surface
   a. Residual asphalt content: 7.5-13.5% weight of dry aggregate
   b. Application rate: 10-15 lbs/sy
3. Type 3: provide wearing surface or build up crown
   a. Residual asphalt content: 6.5-12% weight of dry aggregate
   b. Application rate: 15+ lbs/sy

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth as indicated.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch (25 mm) after milling, before wearing course is laid.
7. Handle milled asphalt material in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Single-Course Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Two-Course Patch Material: Partially fill excavated pavements with hot-mix asphalt base course mix and, while still hot, compact. Cover asphalt base course with compacted layer of hot-mix asphalt surface course, finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints.

1. Clean cracks and joints in existing hot-mix asphalt pavement.
2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.
3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

A. Ensure that prepared subgrade has been proof-rolled and is ready to receive paving. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.

B. Herbicide Treatment: Apply herbicide in accordance with manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 INSTALLATION OF PAVING GEOTEXTILE

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).

B. Place paving geotextile promptly in accordance with manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.8 HOT-MIX ASPHALT PLACEMENT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course and binder course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F (121 deg C).
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches (25 to 38 mm) from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course and binder course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches (150 mm).
3. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method in accordance with AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density, “Superpave" Gyratory Compactor test method: 96 percent of reference laboratory density in accordance with ASTM D6927, but not less than 94 percent or greater than 100 percent.
2. Average Density, Rice Test Method: 92 percent of reference maximum theoretical density in accordance with ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 ASPHALT TRAFFIC-CALMING DEVICES

A. Construct hot-mix asphalt speed bumps, humps, cushions, and tables over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread hot-mix asphalt at a minimum temperature of 250 deg F (121 deg C).

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m).
2. Hot-Mix Asphalt: Same as pavement surface-course mix.
3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch (25 mm) from top of pavement to a clean, rough profile.

B. Place and compact hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.12 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce thickness indicated within the following tolerances:

1. Base Course and Binder Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Pavement Surface Smoothness: Compact each course to produce surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course and Binder Course: 1/4 inch (6 mm)
2. Surface Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to the shapes indicated and within a tolerance of plus or minus 1/8 inch (3 mm) of height indicated above pavement surface.

3.13 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. (0.45 to 0.7 L/sq. m) to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness in accordance with ASTM D3910 and allow to cure.

C. Rolling is needed where slurry thickness exceeds 1/4 inch (6 mm) or for surfaces subject to turning, braking, or accelerating forces.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.14 FIELD QUALITY CONTROL

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

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined in accordance with ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement in accordance with ASTM D979/D979M.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared in accordance with ASTM D2041/D2041M, and compacted in accordance with job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples in accordance with ASTM D1188 or ASTM D2726/D2726M.

    a. One core sample will be taken for every 1000 sq. yd. (836 sq. m) or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method in accordance with ASTM D2950/D2950M and coordinated with ASTM D1188 or ASTM D2726/D2726M.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.15 WASTE HANDLING

A. General: Handle asphalt-paving waste in accordance with approved waste management plan required in Section 017419 "Construction Waste Management and Disposal."

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes concrete paving for the following:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Walks.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for general building applications of concrete.
2. Section 321316 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
3. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
4. Section 321713 "Parking Bumpers."
5. Section 321716 "Manufactured Traffic-Calming Devices."
6. Section 321723 "Pavement Markings."
7. Section 321726 "Tactile Warning Surfacing" for detectable warning tiles, mats, and pavers.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

1. Review methods and procedures related to concrete paving, including but not limited to, the following:

a. Concrete mixture design.
b. Quality control of concrete materials and concrete paving construction practices.

2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete paving Subcontractor.
    e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: Signed by manufacturer certifying that each of the following materials complies with requirements :

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-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 certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests must be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches (2400 mm) by 96 inches (2400 mm)
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F (4.4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 (ACI 301M) and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M) unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet (30.5 m) or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 (Grade 420); deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars.

C. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 (Grade 420) deformed bars; assembled with clips.

D. Plain-Steel Wire: ASTM A1064/A1064M,

E. Deformed-Steel Wire: ASTM A1064/A1064M.

F. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated,

G. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420) plain-steel bars. Cut bars true to length with ends square and free of burrs.

H. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 (Grade 420) plain-steel bars.

I. Tie Bars: ASTM A615/A615M, Grade 60 (Grade 420); deformed.

J. Hook Bolts: ASTM A307, Grade A (ASTM F568M, Property Class 4.6), internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

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

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

L. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

M. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, gray white portland cement Type I/II

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 1, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm)] nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/4 to 1 inch (19 to 25 mm)

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

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. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
   1. Representative Products:
      a. Confilm, Masterbuilders, Inc.
      b. E-con evaporation control, L & M Construction Chemicals, Inc.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing or Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch (3 to 6 mm).

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch (9.5-mm) sieve and 85 percent retained on a No. 8 (2.36-mm) sieve.

2.7 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301 (ACI 301M), for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 3/4-inch (19-mm) Nominal Maximum Aggregate Size: 6 percent plus or minus 1-1/2 percent for ¾ inch nominal maximum.

D. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture, high-range, water-reducing 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.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. (0.60 kg/cu. m)

G. Concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa)
2. Maximum W/C Ratio at Point of Placement: 0.45
3. Slump Limit: 4 inches (100 mm) plus or minus 1 inch (25 mm).

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

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

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. (0.76 cu. m) 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 concrete batches larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph (5 km/h).
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons (13.6 tonnes).
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch (13 mm) according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 INSTALLATION OF STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch (50-mm) overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use bonding agent epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet (15.25 m) unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm) radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

a. Tolerance: Ensure that grooved joints are within 3 inches (75 mm) either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches (75 mm) either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch (6-mm) radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 (ACI 301M) requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 (ACI 301M) by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface.

Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch (1.6 to 3 mm) deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:

1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch (1.6 mm).

1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread per manufacturer specifications of dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Rock-Salt Finish: After initial floating troweling brooming, uniformly spread rock salt over paving surface at the rate of 5 lb/100 sq. ft. (0.2 kg/10 sq. m).

1. Embed rock salt into plastic concrete with roller or magnesium float.
2. Cover paving surface with 1-mil- (0.025-mm-) thick polyethylene sheet and remove sheet when concrete has hardened and seven-day curing period has elapsed.
3. After seven-day curing period, saturate concrete with water and broom-sweep surface to dissolve remaining rock salt, thereby leaving pits and holes..

E. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:

1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. (49 kg/10 sq. m) unless greater amount is recommended by manufacturer to match paving color required.
2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application

of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.

3. After final power floating, apply a hand-troweled finish followed by a broom finish.
4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.9 INSTALLATION OF DETECTABLE WARNINGS

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 321726 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch (6 mm), no minus).

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 321726 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 321726 "Tactile Warning Surfacing" immediately after screeding concrete surface.

C. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic or after application and final floating of pigmented mineral dry-shake hardener, accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m 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.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound or a combination of these as follows:

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 (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.

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.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 (ACI 117M) and as follows:

1. Elevation: 3/4 inch (19 mm).
2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
3. Surface: Gap below 10-feet- (3-m-) long; unleveled straightedge not to exceed 1/2 inch (13 mm).
4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches (13 mm per 300 mm) of tie bar.
5. Lateral Alignment and Spacing of Dowels: 1 inch (25 mm).
6. Vertical Alignment of Dowels: 1/4 inch (6 mm).
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches (6 mm per 300 mm) of dowel.
8. Joint Spacing: 3 inches (75 mm).
9. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.
10. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.12 FIELD QUALITY CONTROL

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

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M will be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) 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 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; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when it is 80 deg F (27 deg C) and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test to be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if 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 (3.4 MPa).

D. Test results to be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests to 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.

E. 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.

F. Additional Tests: Testing and inspecting agency will 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.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.

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- (13-mm-) wide joints formed between two 6-inch- (150-mm-) 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 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For Installer

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: Entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Testing: Performed by a qualified testing agency.

1.7 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 (5 deg C)].
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 for each sealant type.

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.

2.3 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant: ASTM D5893/D5893M, Type NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D5893/D5893M, Type SL.

C. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade NS, Class 25, for Use T.

D. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

E. Multicomponent, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 25, for Use T.

2.4 HOT-APPLIED JOINT SEALANTS

A. Hot-Applied, Single-Component Joint Sealant, Type I: ASTM D6690.

B. Hot-Applied, Single-Component Joint Sealant, Type I or Type II: ASTM D6690.

C. Hot-Applied, Single-Component Joint Sealant, Type I, II, or III: ASTM D6690.

D. Hot-Applied, Single-Component Joint Sealant, Type IV: ASTM D6690.

2.5 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C920, Type S, Grade P, Class 25, for Use T.

B. Fuel-Resistant, Multicomponent, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C920, Type M, Grade P, Class 12-1/2 or 25, for Use T.

2.6 HOT-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants, Type I or Type II: ASTM D7116.

B. Hot-Applied, Fuel-Resistant, Single-Component Joint Sealants, Type III: ASTM D7116.

2.7 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.

2.8 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.

END OF SECTION 321373

SECTION 329223 - SODDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Preparation of planting surface.

B. Fertilizing.

C. Sod installation.

D. Maintenance service.

1.2 RELATED WORK

A. Section 329300 - Plants.

B. Section 328400 – Planting Irrigation.

C. Section 312216 – Fine Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this Section.

1.3 REFERENCES

A. Standardized Plant Names, 1942 Edition, American Joint Committee on Horticulture Nomenclature.

B. ASPA (American Sod Producers Association) - Guideline Specifications to Sodding.

C. FSO-F-241 - Fertilizers, Mixed, Commercial.

1.4 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermudagrass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel and Brome Grass.

1.5 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting with a minimum of 5 years experience.

B. Sod: Root development that will support its own weight, without tearing, when suspended

vertically by holding the upper two corners.

C. Submit sod certification for grass species and location of sod source.

1.6 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.7 TESTS

A. Provide soils tests and recommendations for areas to be sodded. Obtain from approved testing agency. Such tests shall be a composite of random samples. Test areas exhibiting different soil types separately. Provide separate tests for each 10,000 sq. ft. of sodded area.

1.8 MAINTENANCE DATA

A. Submit recommended maintenance procedures to be followed by Owner.

B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

1.10 COORDINATION

A. Coordinate the work of this Section with installation of underground sprinkler system and plant material as applicable.

1.11 MAINTENANCE SERVICE

A. Maintain sodded areas immediately after placement until grass is well established, has achieved complete coverage, and exhibits a vigorous growing condition or until Date of Substantial completion whichever is longer. Maintenance period shall include minimum of two mowings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sod: Cultivated grass sod; type indicated on Drawings; with strong fibrous root system, free of stones, burned or bare spots, and weeds.

B. Fertilizer: Type recommended for grass; of proportions necessary to eliminate any deficiencies of topsoil as indicated in soils test or otherwise approved.

C. Soil Amendments: Lime, sulphur, or other material recommended by soil test.

D. Water: Clean, fresh, and free of substances or matter which could inhibit vigorous growth of grass.

2.2 ACCESSORIES

A. Stakes: Equal to Dewitt 4” Biodegradable Staple. Green color.

2.3 HARVESTING

A. Machine cut sod and load on pallets in accordance with ASPA guidelines.

B. Cut sod with minimum 1/2 inch and maximum one-inch topsoil base.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this Section.

B. Beginning of installation means acceptance of existing site conditions.

3.2 PREPARATION

A. Finish grade areas to be sodded so that the surface is smooth and is approximately 1 inch below adjoining sidewalks and other paved surfaces.

B. Remove all weeds and grasses from areas to be sodded.

C. Planting surface shall be made friable by approved method of scarification. Prepared surface shall be floated smooth and free of bumps and depressions. Remove stones and foreign matter over 2 inches in diameter from top 2 inches of sod bed. Plant immediately thereafter, provided the bed has remained in a friable condition and has not become muddy or hard. If it has become hard, till to a friable condition again.

D. Apply fertilizer per soil tests recommendation. Apply fertilizer prior to installation of sod.

E. Apply fertilizer no more than 48 hours before laying sod.

F. Lightly water to aid the dissipation of fertilizer.

G. Prior to laying sod, incorporate soil amendments such as lime and sulphur at rates recommended by soils tests to a 4-inch depth.

3.3 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Remove plastic netting from sod.

C. Lay sod immediately on delivery to site within 24 hours after harvesting to prevent deterioration.

D. Lay sod tight with no open joints visible and no overlapping; stagger end joints 12-inches minimum. Do not stretch or overlap sod pieces.

E. Finished sodding to be smooth and free of bumps and depression. Surface to be flush with adjoining grass areas if any. Place top elevation of sod approximately 1/2 inch below adjoining edging, paving and curbs. Grade planting surface as necessary to accomplish above.

F. On slopes 4 inches per foot and steeper, lay sod perpendicular to slope and secure every row with biodegradable stakes at maximum 2 feet on center. Drive stakes flush with soil portion of sod.

G. Water sodded areas deeply immediately after installation.

H. After sod and soil have dried sufficiently, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities.

3.4 WARRANTY

A. Sodded areas to be vigorously growing at time of final acceptance or if installation occurs during dormancy warranty to extend through first month of following growing season. At conclusion of initial warranty period replace dead or unhealthy sod.

3.5 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches for Bermudagrass. Do not cut more than 1/3 of grass blade at any one mowing.

B. Neatly trim edges and hand clip where necessary.

C. Immediately remove clippings after mowing and trimming.

D. Water sufficiently to ensure establishment and maintain vigorous appearance.

E. Roll and/or topdress surface as needed to remove minor depressions or irregularities.

F. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

G. Immediately replace sod in areas which show deterioration or bare spots. Any areas that have had topsoil washed away shall be filled to match specified grade with topsoil before resodding.

H. Protect sodded areas with warning signs during maintenance period.

I. Apply approved fertilizer at rate to provide 1-1/2 pounds of actual Nitrogen per 1000 square feet every 25 days during growing season.

J. For the purpose of establishing an acceptable standard, no bare areas will be permitted.

END OF SECTION 329223

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Trees, shrubs, vines and ground cover as applicable.

B. Topsoil backfill.

C. Staking and guying.

D. Maintenance service.

E. Annuals and perennials planting.

1.2 RELATED WORK

A. Section 328400 – Planting Irrigation.

B. Section 329223 - Sodding.

C. Section 312216 - Fine Grading.

1.3 REFERENCES

A. Standardized Plant Names, 1942 edition, American Joint Committee on Horticulture Nomenclature.

B. American Standard for Nursery Stock (ANSI Z60), latest edition, American Association of Nurserymen.

C. FS O-F-241 - Fertilizer, Mixed, Commercial.

1.4 QUALITY ASSURANCE

A. Perform work with personnel experienced in the work required of this Section under direction of a skilled foreman.

B. Submit sources of plant materials. All materials to have name tags attached. Submit invoice with plant names noted if required.

C. Contractor shall locate all materials and be responsible for conformance with requirements of this Section. All plants not meeting requirements to be rejected.

1. Plant submittal to include images of actual nursery stock plant material intended for use on project. Approved nursery stock images shall be used as basis for

quality assurance.

2. All plant material to have name tags attached upon delivery for verification by contractor.

D. All trees are to be reviewed by Owner's Representative prior to planting.

1. Trees will be reviewed at local growing or nursery site by Owner's Representative and approved before delivering to the site. Contractor shall schedule review of plant material in such a manner that no single review period will exceed one working day with a maximum of two review periods. Contractor shall be responsible for notification and coordination with all parties prior to scheduling review sessions.

2. Prior to review by Owner's Representative, Contractor shall have pre-selected all trees and identified each with a "locking" tree tag. Additional tree tags will be provided by Contractor for changes at time of visit. Tree tags will have permanent, non-reproducible identifying notation unique to this project.

E. Submit analysis of topsoil to be retained on site, or to be imported for backfill. Test performed by accredited soils laboratory.

F. Submit soils test and recommendations for amendments including adjusting soil pH to a value between 6.0 and 7.0.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Move B&B plant materials with solid balls wrapped in burlap. Plants to be lifted only by ball or container.

B. Deliver plant materials immediately prior to placement. Keep plant materials not immediately installed moist and protect from freezing by covering ball or container with mulch. Any plants not planted within 2 days of delivery are to be heeled-in in a vertical position, root balls fully encompassed by mulch and a temporary watering system installed.

C. Reject plants when ball or container of earth surrounding roots has been cracked, broken or frozen preparatory to or during process of planting.

1.6 WARRANTY

A. Warrant all plants to be living, healthy specimens for a period of one year commencing upon Date of Substantial Completion. Warranty period shall terminate only if plants have been in full leaf for 30 days at end of warranty period. Termination of warranty period shall be extended as necessary to comply. All materials to be in vigorous condition at end of warranty period.

B. Immediately remove dead plants and plants not in a vigorous condition and replace as

soon as weather conditions permit. Each replacement shall be covered with one year warranty commencing at time of planting.

C. Replacements: Match with adjacent plants of the same species in size and form.

1.7 MAINTENANCE SERVICE

A. Begin maintenance of plant materials immediately after planting and continue until Date of Substantial Completion.

B. Maintenance shall include measures necessary to establish and maintain plants in a vigorous and healthy growing condition. Include the following:
   1. Cultivation and weeding of plant beds and tree pits. When herbicides are used for weed control, apply in accordance with manufacturer's instructions. Remedy damage resulting from use of herbicides.
   2. Watering sufficient to maintain optimum moisture level.
   3. Pruning, including removal of dead or broken branches, and treatment of prune wounds.
   4. Disease and insect control.
   5. Maintaining plants in an upright, plumb position, and repair of settling.
   6. Maintenance of wrappings, guys, turnbuckles and stakes. Adjust turnbuckles or otherwise keep guy wires tight. Repair or replace accessories when required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Trees, Shrubs, Vines, and Ground Cover: Species and size identified in plant list. Plant materials shall be true to name, in good health, free of disease and insects, excellent in form and in complete conformance with ANSI Z60. All materials to be nursery grown.

B. Trees: All trees are to be single-trunk unless otherwise specified.

C. Topsoil: Friable loam, typical of cultivated topsoils locally, containing at least 2% of decayed organic matter (humus) secured from a well drained, arable site, reasonably free of subsoil, stones, earth clods, sticks, roots or other objectionable extraneous matter or debris and containing no toxic materials. Topsoil to have acidity range of 6.0 to 7.0. • Soils tests and amendments as described herein.

D. Mulch: Shredded cedar, cypress or hardwood; dyed brown in color. Double ground hardwood bark mulch equal to that produced by Foster Brothers, Wood Products Inc. www.fosterbros.com. Submit type and source for approval.

E. Fertilizer: Osmocote slow release 18-6-12.

F. Soil acidifier: Equal to TIGER 90 CR Organic Sulphur 0-0-0-90.

G. Compost: "Back to Earth Composted Cotton Burrs", premium compost, course screened, as manufactured by Soil Mender Products, LP, www.soilmender.com.

H. Metal Edging: 3/16 inch x 4 inch steel landscape edging with steel stakes as manufactured by Col-Met, 3333 Miller Park South, Garland, Texas 75042, Phone 972/494-3900, www.colmet.com.

2.2 ACCESSORIES

A. Wrapping Materials: Heavy paper manufactured for tree wrapping purpose.

B. Stakes: Green Metal Fence posts (3 per tree) - 6 foot height.

C. Hardware (cables, wire, eye bolts, and turnbuckles): Noncorrosive; of sufficient strength to withstand wind pressure.

D. Tie straps: Soft polypropylene material equal to ArborTie, by Deep Root Partners, L.P., 31 Langston St., Suite 4, San Francisco, CA, 94103, 1-800-277-7668.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify topsoil is ready to receive the work of this Section. All areas to be planted with shrub or ground cover masses to have minimum 12 inch depth of topsoil.

B. Remove all weeds and grasses from planting beds. Bermuda grass, if present, to be exterminated by approved means or all soil removed to 6 inch depth and replaced with topsoil free of bermuda grass.

C. Stake tree locations and place shrubs, vines, and ground covers for review and final orientation by Owner's Representative prior to installation.

D. Outline bed edges for approval.

E. Prepare topsoil for shrub and ground cover beds, after removing any vegetation with approved procedure, by tilling 2 inch layer 165 CF per 1000 sq. ft.) of compost into the upper 6 inches of soil.

F. Excavate for plant materials. Tree pits shall be 8’ in diameter. Depth to be 18” min. or height of rootball, whichever is greater. Circle to be centered on tree and true in form. Shrub pits shall be 12 inches greater in diameter than root ball. Entire shrub bed areas to be excavated to a min. 12” depth and backfilled with topsoil. Topsoil from excavation may be retained for backfill if it is friable and free of rock and clods greater than 2” in dia. Remove all subsoil, rock, and debris from site. Remove all excavated material from site.

G. Tree pits shall remain open with appropriate safety protection for approval by Owner’s Representative before backfilling.

H. Tree pits to be filled with approved topsoil before planting of trees. Amendments as required by soils test and as approved by Owner’s Representative to be thoroughly incorporated to 8” depth by tilling prior to planting of tree.

I. Set trees with root flare 2 inches above surrounding grade, and other plant materials level with surrounding grade, after settlement.

J. Remove containers from container-grown stock. Set plants in center of pits and backfill with topsoil in 6 inch layers. Pull away ropes, wires, etc. from the top of the ball.

K. Remove any soil from the top of the rootball, to the level of the root flare

L. Final 6 inch layer of backfill around trees to consist of 1:1 mixture of compost..

M. Thoroughly water soil when the hole is half full, and again when full.

N. Apply 1/2 pound fertilizer evenly over cultivated area around each tree and 1 pound per 100 square feet to shrub and ground cover plantings.

O. Evenly spread a 3 inch layer of mulch over tree pits and planting beds.

P. Prune trees and shrubs after planting to improve form and to remove dead and broken branches.

Q. 8’ diameter circular area around trees to be mulched and free of vegetation. For trees 2 inch and greater in caliper, area to be 8 feet in diameter. For trees less than 2 inch caliper, area to be 6 feet in diameter. Circle to be centered on tree and true in form.

R. Wrap trunks of all trees of the Acer and Gledetsia genus.

3.2 PLANT SUPPORT

A. Brace plants upright in position by staking and guying as detailed. Guys to be secured to tree with loops as detailed. All tree staking to be removed by the Contractor at the One Year Warranty review, unless otherwise directed by the Owner, with the stakes becoming the property of the Contractor.

3.3 LANDSCAPE EDGING

A. Install edging in locations shown on Drawings.

B. Edging to be set vertical with top edge 1 inch above grade.

C. Secure edging with metal stakes provided by manufacturer.

D. Horizontal alignment to be true with straight lines and smooth, unbroken curves.

END OF SECTION 329300

SECTION 331100 – FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes private water-distribution piping and related components outside the building for water service and fire-service mains.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

C. Public water distribution piping and related components shall conform to City of Hot Springs Construction Guidelines and Specifications for Water Lines.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene-monomer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

C. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

G. NSF Compliance:

1. Comply with NSF 14 for plastic potable-water-service piping.
2. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use hand wheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 COORDINATION

A. Coordinate connection to water main with City of Hot Springs.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

2.2 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
4. 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.

5. 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.

2.3 JOINING MATERIALS

A. Brazing Filler Metals: AWS A5.8, BCuP Series.

B. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.4 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:

1. Manufacturers: Subject to compliance with requirements of City of Hot Springs.
2. Nonrising-Stem, Resilient-Seated Gate Valves:

a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.

1) Standard: AWWA C509.
2) Minimum Pressure Rating: 200 psig.
3) End Connections: Mechanical joint.

4) Interior Coating: Complying with AWWA C550.

2.5 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements of City of Hot Springs.
2. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

2.6 CHECK VALVES

A. AWWA Check Valves:

1. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
   a. Standard: AWWA C508.
   b. Pressure Rating: 175 psig.

2.7 WATER METERS

1. Water meters will be subject to compliance with requirements of City of Hot Springs.

2.8 WATER METER VAULT

1. Description: Concrete vault with cast-iron cover. Subject to compliance with requirements of City of Hot Springs.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, resilient-seated gate valves with valve box.
2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
3. Use the following for valves in vaults and aboveground:
    a. Gate Valves, NPS 2 and Smaller: Bronze, nonrising stem.
    b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
    c. Check Valves: AWWA C508, swing type.
4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
5. Relief Valves: Use for water-service piping in vaults and aboveground.
    a. Air-Release Valves: To release accumulated air.

b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.

c. Combination Air Valves: To release or admit air.

3.4 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of City of Hot Springs water utility and of size and in location indicated.

B. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

C. Make connections NPS 2 and smaller with drilling machine according to the following:

1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
4. Install corporation valves into service-saddle assemblies.
5. Install manifold for multiple taps in water main.
6. Install curb valve in water-service piping with head pointing up and with service box.

D. Comply with NFPA 24 for fire-service-main piping materials and installation.

E. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

F. Bury piping with depth of cover over top at least 36 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

G. Install piping by tunneling by boring, under streets and other obstructions that cannot be disturbed.

H. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required

for piping material. Make connections to building-water-piping systems when those systems are installed.

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping.

J. See Division 21 Section "Water-Based Fire-Suppression Systems" for fire-suppression-water piping inside the building.

K. See Division 22 Section "Domestic Water Piping" for potable-water piping inside the building.

3.5 JOINT CONSTRUCTION

A. Make pipe joints according to the following:

1. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
2. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

3.6 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Locking mechanical joints.
2. Set-screw mechanical retainer glands.
3. Bolted flanged joints.
4. Heat-fused joints.
5. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.8 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according requirements of City of Hot Springs.

3.9 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.11 CONNECTIONS

A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

B. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

D. Connect water-distribution piping to interior domestic water piping.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.12 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.13 IDENTIFICATION

A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 31 Section "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

3.14 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.

3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.

b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.

c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.

d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331100

SECTION 333100 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure, sanitary sewerage outside the building, with the following components:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Cleanouts.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene-monomer rubber.

B. LLDPE: Linear low-density, polyethylene plastic.

C. PE: Polyethylene plastic.

D. PVC: Polyvinyl chloride plastic.

E. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Pipe materials.
2. Special pipe fittings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: AWWA C151, for push-on joints.

B. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153, for push-on joints.

D. Gaskets: AWWA C111, rubber.

2.3 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell end.
3. Gaskets: ASTM F 477, elastomeric seals.

2.4 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification: Heavy and Extra-heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi (27.6 MPa) minimum, with 0.45 maximum water/cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60 (420 MPa), deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
    a. Shielded flexiblecouplings for same or minor difference OD pipes.
    b. Shielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewerage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install cleanouts for changes in direction, unless fittings are indicated. Use fittings for branch connections, unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Install gravity-flow, nonpressure, drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
3. Install piping with 36-inch minimum cover.
4. Install piping below frost line.
5. Install ductile-iron special fittings according to AWWA C600.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.4 PIPE JOINT CONSTRUCTION

A. Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
2. Join ductile-iron and special fittings according to AWWA C600 or AWWA M41.
3. Join ABS sewer piping according to ASTM D 2321 and ASTM D 2751 for elastomeric-seal joints.

4. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
5. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.6 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use extra-heavy-duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.7 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."

B. Make connection to existing manhole.
   1. Core manhole wall at location and elevation indicated on plans. Fill annular void area with non shrink grout after making pipe connection.

3.8 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.
   1. Use warning tape or detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.9 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Allowable leakage is maximum of 50 gal./inch of nominal pipe size per mile of pipe, during 24-hour period.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.
    f. Option: Test ductile-iron piping according to AWWA C600, "Hydrostatic Testing" Section. Use test pressure of at least 10 psig.
6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Option: Test plastic gravity sewer piping according to ASTM F 1417.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

A. Clean interior of piping of dirt and superfluous material. Flush with potable water.

END OF SECTION 333100

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes gravity-flow, nonpressure storm drainage outside the building, with the following components:

1. Drains.
2. Precast concrete manholes.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene-monomer rubber.

B. LLPE: Linear low-density, polyethylene plastic.

C. HDPE: High density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PVC: Polyvinyl chloride plastic.

F. TPE: Thermoplastic elastomer.

G. CPP: Corrugated Polypropylene

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: 10-foot head of water. Pipe joints shall be at least silt tight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Catch Basins
2. Pipe and fittings
3. Manholes

4. Stormwater Inlets

B. Shop Drawings: For the following:

1. Catch Basins and Stormwater Inlets. Include plans, elevations, sections, details, and frames, covers, and grates.

C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes, catch basins, and stormwater inlets according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.2 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings NPS 10 and Smaller: AASHTO M 252M, Type S, with smooth waterway for coupling joints.

1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

B. Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

C. Corrugated PE Pipe and Fittings NPS 56 and NPS 60: AASHTO MP7, Type S, with smooth waterway for coupling joints.

1. Silt tight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

2.3 PVC PIPE AND FITTINGS

A. PVC Water-Service Pipe and Fittings: ASTM D 1785, Schedule 40 pipe, with plain ends for solvent-cemented joints with ASTM D 2466, Schedule 40, socket-type fittings.

B. PVC Sewer Pipe and Fittings, NPS 15 (DN 375) and Smaller: ASTM D 3034, SDR 35 with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

C. PVC Sewer Pipe and Fittings, NPS 18 (DN 450) and Larger: ASTM F 679, T-[1] [2] wall thickness, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

D. PVC Profile Gravity Sewer Pipe and Fittings: ASTM F 794 pipe, with bell-and-spigot ends; ASTM D 3034 fittings, with bell ends; and ASTM F 477, elastomeric seals.

2.4 CPP PIPE AND FITTINGS

A. CPP Sewer Pipe and Fittings: ASTM F2881, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

B. Polypropylene compound shall be impact modified copolymer meeting the material requirements of ASTM F2881, Section 5 and AASHTO M330, Section 6.1.

C. ADS HP Storm Pipe, or approved equal

2.5 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D 2729, bell-and-spigot ends, for loose joints.

2.6 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76, with bell-and-spigot or groove and tongue ends. Wall B.

2.7 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.8 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

1. Top-Loading Classification(s): Extra-heavy duty.
2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.9 CONCRETE

A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.

1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.10 CATCH BASINS

A. Standard Precast Concrete Catch Basins: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.

1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.
3. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
4. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
5. Adjusting Rings: Interlocking rings with level or sloped edge in thickness and shape matching catch basin frame and grate. Include sealant recommended by ring manufacturer.
6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match 24-inch-diameter frame and grate.
7. Steps: Individual FRP steps, wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps

into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.

8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

2.11 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

2.12 PIPING INSTALLATION

A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

2.13 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

2.14 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

2.15 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

2.16 DRAINAGE SYSTEM INSTALLATION

A. Assemble and install components according to manufacturer's written instructions.

B. Install with top surfaces of components, except piping, flush with finished surface.

C. Assemble channel sections to form slope down toward drain outlets. Use sealants, adhesives, fasteners, and other materials recommended by system manufacturer.

D. Embed channel sections and drainage specialties in 4-inch (102-mm) minimum concrete around bottom and sides.

E. Fasten grates to channel sections if indicated.

F. Assemble channel sections with flanged or interlocking joints.

G. Embed channel sections in 4-inch (102-mm) minimum concrete around bottom and sides.

2.17 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

2.18 CLEANING

A. Clean interior of piping of dirt and superfluous materials.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

a. Shielded flexible couplings for same or minor difference OD pipes.

b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.

c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

2. Use pressure-type pipe couplings for force-main joints.

B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.

C. Gravity-Flow, Nonpressure Sewer Piping: Use piping materials as indicated on plan.

3.3 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

F. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.

2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.

3. Install piping with 36-inch minimum cover.

4. Install piping below frost line.

5. Install PE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
6. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
7. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.

B. Join gravity-flow, nonpressure drainage piping according to the following:

1. Join corrugated PE piping according to CPPA 100 and the following:
    a. Use silt tight couplings for Type 1, silt tight joints.
2. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
3. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
4. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints and proper tolerances for the Omni-flex gaskets.
5. Join dissimilar pipe materials with nonpressure-type flexible couplings.

C. Join dissimilar pipe materials with pressure-type couplings.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use light-duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification cleanouts in roads areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.

1. Use light-duty, top-loading classification drains in earth or unpaved foot-traffic areas.
2. Use medium-duty, top-loading classification drains in paved foot-traffic areas.
3. Use heavy-duty, top-loading classification drains in vehicle-traffic service areas.
4. Use extra-heavy-duty, top-loading classification drains in roads areas.

B. Embed drains in 4-inch minimum depth of concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

3.7 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.8 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.9 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318/318R.

3.10 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill according to piping manufacturer's written instructions.

3.11 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

1. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Connect to sediment interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.12 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.

1. Use warning tape over piping and over edges of underground structures.

3.13 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Re-inspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.

4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924.
    d. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
    e. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.14 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water as required.

END OF SECTION 334100