AFFORDABLE SENIOR LIVING LDHALP

GREYSTONE APARTMENTS

DETROIT, MICHIGAN

Issued for Construction: December 19, 2025

SPECIFICATIONS

Affordable Senior Living LDHALP
GREYSTONE APARTMENTS
Detroit, Michigan

CASS CORRIDOR NEIGHBORHOOD DEVELOPMENT CORP.
Owner
Detroit, Michigan 48201

FUSCO, SHAFFER & PAPPAS, INC.
Architects and Planners
550 East Nine Mile Road
Ferndale, Michigan 48220
(248)543-4100

GEORGE JEROME & CO
Civil Engineer
28304 Hayes Road
Roseville, Michigan 48066
(586)774-3000

DEAK PLANNING + DESIGN
Landscape Architect
143 Cadycentre #79
Northville, Michigan 48167
(866)355-4204

RESURGET ENGINEERING PC
Structural Engineer
28 W. Adams Avenue, Suite 1710
Detroit, Michigan, 48226
(313)315-3290

IMEG CORP.
Mechanical and Electrical Engineers
3001 Broadway Street NE, Suite 601
Minneapolis, Minnesota 55413
(612)540-5000

G. FISHER CONSTUCTION COMPANY
General Contractor
31313 Northwestern HWY #206
Farmington Hills, Michigan 48334
(248)855-3500

AFFORDABLE SENIOR LIVING LDHALP
GREYSTONE APARTMENTS
DETROIT MICHIGAN

Issued for Construction: December 19, 2025

SIGNATURE SHEET

Affordable Senior Living LDHALP
GREYSTONE APARTMENTS
Detroit, Michigan

OWNER:
CASS CORRIDOR NEIGHBORHOOD DEVELOPMENT CORP.

BY _____

ARCHITECT:
FUSCO, SHAFFER & PAPPAS, INC.

BY _____

GENERAL CONTRACTOR:
G. FISHER CONSTUCTION COMPANY BY _____

SURETY COMPANY BY _____

MSHDA BY _____

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SECTION 002113 - INSTRUCTIONS TO BIDDERS

PART 1 – GENERAL

1.1 DEFINITIONS

A. Pre-qualified Contractors are contractors that have been vetted by the Contractor and deemed worthy of executing the Work. The Owner shall be the sole arbiter of the necessary qualifications and shall reserve the right to add or subtract contractors at their sole discretion. Pre-qualified Contractors shall hereby be called 'Bidders' for the purposes of this section.

B. Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

C. Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

D. Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

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

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

G. An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

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

I. A Bidder is a pre-qualified contractor (person or entity) who submits a Bid and who meets the requirements set forth in the Bidding Documents.

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

1.2 BIDDER'S REPRESENTATIONS

A. The Bidder by making a Bid represents that:

1. The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

2. The Bid is made in compliance with the Bidding Documents.
3. The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.
4. The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included in the submitted bid the cost of such fees, permits, and requirements not otherwise indicated as provided by Owner.
5. The Bidder is a properly licensed Contractor according to the laws and regulations of the City of Detroit and the state of Michigan and meets qualifications indicated in the Procurement and Contracting Documents.
6. The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.
7. The Bidder has incorporated into the Bid adequate sums for work performed by installers whose qualifications meet those indicated in the Procurement and Contracting Documents.
8. The Bidder has provided sufficient evidence of the bonding capacity required for the project.

1.3 BIDDING DOCUMENTS

A. Distribution of complete sets of Bidding Documents to pre-qualified contractors shall be via electronic format selected by the Architect. Documents will be in PDF format. The Bidding Documents are made available for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

B. Bidding Documents will not be issued directly to Sub-bidders.

C. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

1.4 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

A. The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

B. Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

C. Bidders shall submit Request's for Interpretation/Information using the form found at the end of this section. All RFI's shall be submitted by the Bidder electronically. RFI's from Sub-bidders will be dismissed.

D. Responses to RFI's will be issued via Addendum.

1.5 SUBSTITUTIONS

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

B. No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests

shall be made in accordance with Section 12500 Substitution Procedures. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

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

1.6 ADDENDA

A. Addenda will be transmitted to all pre-qualified contractors. Addendums will not be sent to Sub-bidders.

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

C. Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

1.7 BIDDING PROCEDURES

A. Refer to requirements set forth by the CM.

1.8 SUBMISSION OF BIDS

A. Refer to requirements set forth by the CM.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 21 13

SECTION 003126 – HAZARDOUS MATERIAL ASSESSMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The environmental consultant is ATC.

B. The Environmental Report consists of the following:
   1. Asbestos Inspection report dated December 27, 2018.
   2. Lead-Based Paint Inspection/Risk Assessment report dated January 16, 2019.

C. A copy of Attachment A "Asbestos Inspection Tables" from the Asbestos Inspection report as appended to this Document.

D. A copy of the sampling from the Lead-Based Paint Inspection/Risk Assessment report as appended to this Document.

E. A copy of the complete environmental reports is available from the Owner or Construction Manager upon written request.

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

PART 3 - **EXECUTION** (Not Used)

END OF SECTION 003126

SECTION 003132 – GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 SUMMARY

A. The geotechnical consultant is McDowell & Associates 21355 Hatcher Avenue, Ferndale MI 48220.

B. The Geotechnical Report consists of the following:
   1. McDowell report dated December 5, 2022.

C. A copy of the complete geotechnical report is available from the Owner or Construction Manager upon written request.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 003132

SECTION 010000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

A. The AIA General Conditions for the Contract, Supplementary General Conditions and these General Requirements shall be considered as an inclusive part of each division of these specifications. All subcontractors as well as the General Contractor shall be governed by all applicable sections of these documents with reference to their respective areas of work. It shall be the responsibility of the General Contractor to apprise all subcontractors and suppliers of these requirements.

B. Where the specifications refer to products of one or more manufacturers, such references designate the type, quality, size, grade, style, etc. of materials or equipment to be furnished and are not intended to restrict competitive bidding. Written approval of the Architect must be secured for use of any alternate material or product.

C. The drawings and these specifications are intended to be complementary, what is called for by either shall be as binding as if called for by both. Any discrepancies found between the drawings and the specifications shall be brought to the attention of the Architect for the interpretation of the intent of the contract documents.

D. It shall be the responsibility of the General Contractor and all subcontractors to have examined and reviewed the existing building, the site and the complete set of working drawings and specifications and to provide all labor and material for their respective area of work for a complete and finished installation in compliance with the intent of the drawings and specifications whether indicated or not, all work shall be in compliance with all codes and ordinances that are applicable to the project. Costs for permits, bonds, fees, etc., shall be the responsibility of each subcontractor.

1. Submittal of proposal implies that the Bidder is fully conversant with all requirements of all said Divisions and Documents. No claims for additional compensation will be entertained or paid to any Contractor or Subcontractor on account of his failure to be fully informed of all requirements of all documents.

E. The General Contractor shall keep a competent superintendent on site at all times during the entire progress of the work.

F. Subcontractors shall cooperate with each other and with the General Contractor to provide materials and labor that are necessary in each other's work at the proper times so that the construction schedule is not affected. These interfacings shall be the responsibility of the subcontractors whose work is affected as such.

G. Every subcontractor is to remove his own debris from jobsite and to keep areas of this work in broom swept condition as directed by the job superintendent.

H. In no instance shall any contractor or subcontractor substitute any material or process stipulated or scheduled in these Specifications or the Drawings without prior written approval of Architect. In preparation of Bid Proposals, should any subcontractor desire to change or substitute any

material or construction process utilized in Contract Drawings and Specifications, he may request same upon written notification to Architect and by identifying in his Bid Proposal any such proposed changes, alterations or omissions.

1. Where the specifications refer to products of one or more manufacturers, such references designate the type, quality, size, grade, style, etc., of materials or equipment to be furnished and are not intended to restrict competitive bidding. Written approval of the Architect must be secured for use of any alternate material or product.

2. See also, Section 012500 "Substitution Procedures." Where the construction documents and the specifications conflict, in general the strictest provision will prevail; however, the Architect will be the sole arbiter of which provision applies.

I. Shop drawings: Refer to Section 013300 "Submittal Procedures."

1.2 LAYING OUT OF WORK

A. The General Contractor shall locate and provide all general reference points and take ordinary precautions to prevent their destruction. Each subcontractor shall be responsible for laying out his own work and shall be responsible for all lines, elevations measurements, grading and other as may be required by his work. He shall be held responsible for verifying all figures and details shown on the drawings, which relate to his work, prior to laying out the work. He will be held responsible for any error resulting from this failure to take such precautions.

B. The General Contractor shall be responsible for establishing field benchmarks for the purpose of establishing required elevations. The stakes shall be sufficiently far enough away from the work so as not to be disturbed.

1.3 TEMPORARY FIELD OFFICE

A. The General Contractor shall provide and maintain a watertight field office for his own use and that of the Architect and the Owner for the duration of the project. The office shall be properly heated, lighted and equipped with tables, filing space for drawings and a telephone.

1.4 FIELD DRAWINGS AND RECORD DRAWINGS

A. Refer to Section 017839 "Project Record Documents."

1.5 STORAGE SHEDS

A. Prime subcontractors shall furnish storage facilities large enough to hold all materials that might be subject to damage or vandalism, that are required on the site at any one time. The facilities shall be adequately constructed so as to prevent damage from the elements and so they can be adequately secured. Location on the site shall be as per the General Contractor's instructions. Each subcontractor shall bear the responsibility for the security of his own materials and equipment.

1.6 SAFE PREMISES

A. It shall be the responsibility of each subcontractor to maintain all areas adjacent to the construction site in a manner not to hinder or endanger normal traffic flow, or endanger or damage adjacent property.

B. Streets and sidewalks adjacent to the site shall be kept clean and open for pedestrian and vehicular traffic. Warning lights, guards and barricades shall be utilized and maintained as required to ensure these conditions by the subcontractor whose work is partially or totally in the above stated area. General Contractor shall provide for all temporary walk areas required for access to the building area and as necessary to carry out the work.

C. The responsible subcontractor is to provide scaffolding necessary for all of his work. All scaffolding must be built in accordance with the requirements of federal, state and local regulations.

D. Temporary stairs, ladders and ramps shall be provided by the subcontractor for his work in order to safely enable access to all parts of the work by the Architect, the Owner and any authorized inspecting personnel. All such equipment shall meet all federal, state and local safety requirements.

1.7 TEMPORARY UTILITIES

A. Lighting and power:

1. The electrical subcontractor shall provide all temporary electric service and lighting required during the entire construction period and pay for all costs for installing, maintaining and removing temporary service. Include all necessary temporary wiring, panelboards, outlets, switches, lamps, fuses, controls and accessories.

2. Provide a sufficient number of electric outlets located so that 50 foot long extension cords will reach all work requiring light or power. All temporary 120 V, 15 and 20 amp receptacle outlets shall be G.F.I. protected. All temporary service equipment shall be removed by the Electrical subcontractor when so instructed by the General Contractor. The General Contractor shall be responsible for payment of the electric bill.

B. Water:

1. The General Contractor shall pay for all water required during the entire construction period. The site utilities subcontractor shall pay tap fees and shall lay a temporary water line from the source, fit with a hose bibb, and shall provide and maintain all valves, connections and hoses.

2. The General Contractor shall furnish drinking water from an approved source for all persons on the work. Each subcontractor shall be responsible to provide containers for his own men.

3. If the use period for the temporary water installation includes freezing weather, the site utilities subcontractor shall provide insulation for all exposed temporary service piping to prevent freezing.

C. Heat:

1. Each subcontractor shall provide temporary heat as necessary to protect all of his work and materials from damaging dampness and freezing. Temperatures shall be maintained as per ASTM requirements. Precautions shall be taken against possible spread of fire and the possible damaging effects to building and equipment from smoke and soot.

1.8 TEMPORARY TOILETS

A. The General Contractor shall provide and maintain in a sanitary manner, temporary toilets as necessary for the use of the workmen.

1.9 TESTS AND INSPECTIONS

A. Unless otherwise noted, the General Contractor shall cause to be performed, all inspections and tests required in each Section of the Specifications. Notify each inspecting or testing authority or agency 24 hours in advance of each test or inspection required. Keep records of each test or inspection. Include in such records the time of the test or inspection, weather conditions, names of inspector or testing authority, results of the test and all other pertinent data. In addition to any other distribution, submit a copy of each report or test result as it is made to the Architect for his review.

1.10 LEAD BASED PAINT RENOVATION, REPAIR AND PAINTING PROCEDURE REQUIREMENTS

A. Under the Residential Lead-based Hazard Reduction Act Of 1992, Congress required the EPA to develop regulations to address renovation, repair and painting (RRP) activities in single and multifamily housing built before 1978. The purpose of the new rule is to reduce children's exposure to dust containing lead paint created during the course of these activities. This rule is effective as of April 22,2010.

B. If any testing associated with any Renovation, Repair and Painting (RRP) activities is done, the results of that testing must be disclosed and available to any interested party.

C. Responsibility to comply with the new rule rests with the contractor. Contractors and workers must be trained and certified by the EPA to conduct the new lead paint safe work practices while performing RRP activities in housing constructed prior to 1978.

D. Contractors shall be responsible for contacting occupants of dwelling units in writing prior to commencing work.

E. Exemptions: These rules may be waived under the following conditions:

1. The dwelling unit or facility was built after January 1, 1978.

2. The repairs are minor, with the interior work disturbing less than six square feet or exteriors disturbing less than twenty square feet

3. If the components of the dwelling unit test lead free by a Certified Risk Assessor, Lead Inspector, or Certified Renovator.

1.11 VERMIN EXTERMINATION

A. The General Contractor shall be responsible to contract for the extermination of all insects, rodents and other pests within the contract area of the building prior to turning each building over to the Owner. In accordance with Integrated Pest Management guidelines, seal all cracks and crevices with low VOC caulks and sealants, use copper mesh screens to seal holes prior to drywall finish.

1.12 GENERAL CONTRACTOR AND SUBCONTRACTOR INSURANCE

A. The General Contractor and each subcontractor is required to purchase and maintain the following types of insurance:

1. Workman's Compensation

2. Public Liability Insurance with the following minimum coverage.

   a. General Liability-$1,000,000 per occurrence.

   b. Bodily Injury-Minimum of $1,000,000 per occurrence.

   c. Property Damage-Minimum of $1,000,000.

3. Appropriate insurance certificates must be submitted prior to any payment requests.

1.13 GUARANTEE PERIOD

A. The General Contractor shall and hereby does guarantee and warrant that all work for this development, under this Contract, shall be free from defects or faulty labor and/or materials for a period of one (1) year from date of Substantial Completion of the project, except when longer periods are herein specified, which develop within any guarantee periods.

1.14 USE OF FACILITIES

A. If the General Contractor or any of the Subcontractors or separate Contractors chooses to use any system, equipment, facilities or services which have been installed into the building as a permanent part thereof by any other Subcontractors or separate Contractor, such Contractor shall assume full responsibility for damage to said system, equipment, facilities or services, and shall make such arrangements with the installing Subcontractor as are necessary so that in no case shall the extent of the guarantee period mentioned above be jeopardized as a result of such use.

1.15 SPECIAL CONDITIONS

A. Substitutions in the specified work shall be covered by the following statement in the Special Conditions: “Material and Workmanship.” Unless otherwise specifically provided in this contract, reference to any equipment, material, article, or patented process, by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The contractor may, at his option, use any equipment, material, article or process, which, in the judgment of the Owner, is equal to that named. The

contractor shall furnish to the Owner for approval the name of the manufacturer, the model number, and other identifying data and information respecting the performance, capacity, nature, and rating of the machinery and mechanical and other equipment, which the Contractor contemplates incorporating in the work. When required by its contract or when called for by the Owner, the Contractor shall furnish the Owner for approval, full information concerning the material or articles, which the contractor contemplates incorporating into the work. When directed, samples shall be submitted for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles installed or used without required approval shall be at the risk of subsequent rejection.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 010000

SECTION 011000 – SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Project Information.
2. Work covered by Contract documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 10 00.01 “General Conditions”, for a copy of the AIA General Conditions for the Contract.

1.3 PROJECT INFORMATION

A. Project Identification: Dunn Family Apartments

1. Project Location: 8400 Engleman St., Center Line, Michigan 48015
2. Owner: CSI Support & Development Services

B. Architect: Fusco Shaffer & Pappas, Inc.

C. Construction Manager: Kasco Construction Services, Inc.

1. The terms "Construction Manager" and "Contractor" are synonymous.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Project includes all Civil, Landscape, Architectural, Structural, Mechanical, and Plumbing work to provide a complete and functional building with all applicable permits and licenses obtained. Building will require inspection and approval from the City of Detroit. See the drawings and specifications for a delineation of required work.

2. The project will contain approximately 51,188 square feet of enclosed space in a residential apartment building. The building will have 4 stories and have a central core with elevators, mailroom, lobby, reception, mechanical room, and offices on the first story. Two stair towers join the building with a series of 2 main corridors, one running east to west and one running north to south. The second through fourth floors replace the community areas with additional housing units.

3. The building is a type VA construction with a primary wood frame. Ground floor will be slab on grade, the exterior walls will be clad in a combination of fiber cement panels and brick. The building has a flat roof with a TPO roofing protection membrane board with 6" rigid insulation and an air & vapor barrier on a plywood roof deck and wood roof joists.

4. See Drawings for Code Review.

1.5 ACCESS TO SITE

A. General: Contractor shall have full use of Project Site for construction operations during construction period.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

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

B. Nonsmoking Building: Smoking is not permitted on the property.

C. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

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

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 011000.01 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. AIA Document A201-2007, General Conditions for the Contract for Construction as appended to this Document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000.01

DRAFT

AIA® Document A201® – 2017

General Conditions of the Contract for Construction

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

« »
« »

THE OWNER:
(Name, legal status and address)

« »« »
« »

THE ARCHITECT:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

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

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INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

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

§ 1.2 Correlation and Intent of the Contract Documents

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

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

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

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

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

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

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

§ 1.6 Notice

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

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

§ 1.7 Digital Data Use and Transmission

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

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set

forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

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

§ 2.2 Evidence of the Owner's Financial Arrangements

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

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

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

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

§ 2.3 Information and Services Required of the Owner

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

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

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

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

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

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

§ 2.4 Owner's Right to Stop the Work

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

§ 2.5 Owner's Right to Carry Out the Work

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

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

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

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

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

§ 3.3 Supervision and Construction Procedures

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

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

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

§ 3.4 Labor and Materials

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

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

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

§ 3.5 Warranty

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

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

§ 3.6 Taxes

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

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

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

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

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

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

§ 3.9 Superintendent

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

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

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

§ 3.10 Contractor's Construction and Submittal Schedules

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

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

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

§ 3.11 Documents and Samples at the Site

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

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

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

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

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

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

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

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

§ 3.15 Cleaning Up

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

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

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

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

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

§ 4.2 Administration of the Contract

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

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

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not

have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

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

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

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

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

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

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

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

§ 5.3 Subcontractual Relations

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

similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

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

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

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

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

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

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

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

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

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

§ 6.2 Mutual Responsibility

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

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the

Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

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

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

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.3.4.

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

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

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

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

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

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

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

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

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor

change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

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

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

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

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

§ 8.2 Progress and Completion

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

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

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

§ 8.3 Delays and Extensions of Time

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

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

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

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

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

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

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

§ 9.4 Certificates for Payment

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

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

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot

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

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

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

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

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

§ 9.6 Progress Payments

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

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

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

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

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

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

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

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

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

§ 9.9 Partial Occupancy or Use

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

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

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

§ 9.10 Final Completion and Final Payment

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

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

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

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

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;

.2 failure of the Work to comply with the requirements of the Contract Documents;

.3 terms of special warranties required by the Contract Documents; or

.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

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

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

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

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

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

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

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

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

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

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

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

§ 10.2.8 Injury or Damage to Person or Property

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

§ 10.3 Hazardous Materials and Substances

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

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

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

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

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

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

§ 10.4 Emergencies

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

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

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

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

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

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

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

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

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

§ 11.3 Waivers of Subrogation

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

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

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

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

§11.5 Adjustment and Settlement of Insured Loss

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

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

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

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

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

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

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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

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

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

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

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

§ 12.3 Acceptance of Nonconforming Work

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

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

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

§ 13.2 Successors and Assigns

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

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

§ 13.3 Rights and Remedies

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

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

§ 13.4 Tests and Inspections

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

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

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

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

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

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

§ 13.5 Interest

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

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

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

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

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

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

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

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

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

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

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

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

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

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

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

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

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

§ 14.4 Termination by the Owner for Convenience

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

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

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

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

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

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

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

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

§ 15.1.2 Time Limits on Claims

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

§ 15.1.3 Notice of Claims

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

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

§ 15.1.4 Continuing Contract Performance

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

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

§ 15.1.5 Claims for Additional Cost

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

§ 15.1.6 Claims for Additional Time

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

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

§ 15.1.7 Waiver of Claims for Consequential Damages

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

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

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

§ 15.2 Initial Decision

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

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

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

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

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

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

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

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

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

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

§ 15.3 Mediation

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

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

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

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

§ 15.4 Arbitration

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

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

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

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

§ 15.4.4 Consolidation or Joinder

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

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

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

SECTION 011000.02 – SUPPLIMENTAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including General Conditions and Division 1, General Requirements, apply to work specified in this section. Wherever the General Conditions are referred to in the specifications, such reference shall be understood to include these Supplemental General Conditions.

B. Contractors and Subcontractor's Insurance (Refer to General Conditions).

C. The Contractor shall not commence work under this contract until he has obtained the insurance required under this paragraph, nor shall the Contractor permit any Subcontractor to commence work on his subcontract until the insurance required of the Subcontractor has been so obtained.

1. Workmen's Compensation Insurance: The Contractor shall procure and shall maintain during the life of this contract, Workmen's Compensation Insurance for all of his employees to be engaged in work on the project under this contract and in case any such work is sublet, the Contractor shall require the Subcontractor similarly to provide Workmen's Compensation for all of the latter's employees to be engaged in such work.

2. Contractor's Public Liability and Property Damage Insurance: The Contractor shall procure and shall maintain during the life of this contract, Contractor's Public Liability Insurance in an amount not less than $1,000,000 for injuries, including accidental death arising out of any one occurrence; and Contractor's property damage insurance shall be in an amount not less than $1,000,000 each occurrence and $2,000,000 aggregate.

    a. See paragraph 3 for "Owner's and Contractor's Protective Public Liability and Property Damage Insurance.

3. Contractors Motor Vehicle Bodily Injury and Property Damage Insurance: The Contractor shall procure and shall maintain during the life of this contract, Motor Vehicle Bodily Injury Insurance (Comprehensive Form) in an amount not less than $100,000 for injuries, including accidental death arising out of any one occurrence; and property damage in an amount not less than $2,000,000 for each occurrence.

    a. The Contractor shall procure and shall maintain, during the life of this contract, Hired and Non-Ownership Motor Vehicle Bodily Injury and Property Damage Insurance in an amount not less than $1,000,000 for injuries, including accidental death arising out of any one occurrence; and property damage in an amount not less than $2,000,000 for each occurrence.

4. Proof of Carriage of Insurance: The Contractor shall provide the Owner at the time contracts are returned by him for execution, certificates and policies listed below. A guarantee that fifteen (15) days notice to the Owner prior to cancellation of, or change in, any such insurance shall be endorsed on each policy and certificate of insurance.
    a. Four (4) copies of Certificate of Coverage of Contractor's Workmen's Compensation Insurance.

b. Four (4) copies of Certificate of Coverage of Contractor's Public Liability and Property Damage Insurance.

c. Four (4) copies of certificate of Coverage of Contractor's Motor Vehicle Bodily Injury and Property Damage Insurance covering Owner, Hired and Non-Owned vehicles.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000.02

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 30 00 “Submittal Procedures” for requirements for issuing the ‘Submittal Schedule.”
2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 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 Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
2. 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

1.3 ACTION SUBMITTALS

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

1. Substitution Request Form: Use CSI Form 13.1A.
2. 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 2012 Michigan Building Code.
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. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

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

1.4 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.

1.5 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: Submit requests for substitution immediately on discovery of need for change, but not later than 7 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: Architect will consider requests for substitution if received within 120 days after commencement of the Work. Requests for change to a similar product by a Manufacturer not listed in section two of the appropriate specification section shall be submitted a minimum of 60 in advance of the official Submittal Schedule prepared by the Contractor. Requests received after that time may be considered or rejected at discretion of Architect.

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

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

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
2. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Section 012500 “Substitution Procedures” - Special attention shall be given to coordination of Substitution Procedures and Submittal Schedule requirements of this section.

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."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

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

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals

required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule or within the first 60 days, whichever is sooner.
   a. Submit revised submittal schedule 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.
   g. Scheduled date of fabrication.
   h. Scheduled dates for purchasing.
   i. Scheduled dates for installation.
   j. Activity or event number.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
   a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
   b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD 2016.
   c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Architect.
   d. The following digital data files will be furnished for each appropriate discipline:
      1) Floor plans.
      2) Reflected ceiling plans.

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 different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the

Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 7 days for review of each resubmittal.
4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 7 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

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

   a. Project name.
   b. Number and title of appropriate Specification Section.

c. Manufacturer name.
d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. 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.

H. 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.

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

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
   a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Submit electronic submittals via email as PDF electronic files.
   a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
3. Action Submittals: Submit electronic files. Architect will return an electronic file.
4. Informational Submittals: Submit electronic files. Architect will return an electronic file.
5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
   a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
   b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
    a. PDF electronic file.
    b. Three paper copies of Product Data unless otherwise indicated. Architect will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, 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.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:
    a. PDF electronic file.
    b. Two opaque (bond) copies of each submittal. Architect will return one copy.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

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

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

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect and GC will retain two Sample sets; 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.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. 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.
5. Submit product schedule in the following format:
   a. PDF electronic file.
   b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
G. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

H. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

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

J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

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

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect and General Contractor will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

END OF SECTION 01 33 00

SECTION 015000 - 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.
2. See civil drawings for "Dewatering" for disposal of ground water at Project site.
3. See civil drawings for "Asphalt Paving" for construction and maintenance of asphalt pavement for temporary roads and paved areas.
4. See civil drawings for "Concrete Paving" for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

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

C. Sewer, Water, and Electric Power Service: Use charges are specified in Section 011200 "Multiple Contract Summary."

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

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

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

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. 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.

E. 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. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

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.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

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. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches .

B. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, Construction Manager, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F .
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

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

B. 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 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 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 011000 "Summary."

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

3.2 TEMPORARY UTILITY INSTALLATION

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

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

B. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

C. 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.
2. Install lighting for Project identification sign.

D. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

    a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

    a. Police and fire departments.
    b. Ambulance service.
    c. Contractor's home office.
    d. Contractor's emergency after-hours telephone number.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

E. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
2. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
3. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
4. Backup: External hard drive, minimum 40 gigabyte, with automated backup software providing daily backups.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. 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. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: 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 touchup signs so they are legible at all times.

C. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

E. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

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

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

C. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

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

3.6 OPERATION, TERMINATION, AND REMOVAL

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

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

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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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

E. 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 roads and 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 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
1. Section 01 25 00 "Substitution Procedures" for requests for substitutions.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or

rejection of proposed comparable product request within 21 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

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 to determine that products are undamaged and properly protected.

C. Storage:

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

7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. See other Sections for specific content requirements and particular requirements for submitting special warranties.
3. The costs for special warranties shall be presented to the Owner as an Add Alternate and not included in the base bid.

C. Submittal Time: Comply with requirements in Section 01 77 00 "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 not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Correction of the Work.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 3 300 "Submittal Procedures" for submitting surveys.
3. 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, and final cleaning.
4. Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

B. Final Property Survey: Submit 10 copies showing the Work performed and record survey data as well as an electronic file in AutoCAD and PDF format.

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, 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. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. 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.
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. 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.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

D. Surface and Substrate Preparation: Comply with manufacturer's written recommendations for preparation of substrates to receive subsequent work.

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. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor to lay out the Work using 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 and Construction Manager 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 and Construction Manager.

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 or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager 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. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. 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. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. 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. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

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 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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 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. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000

"Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 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. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

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

1. Recycling nonhazardous construction waste.
2. Disposing of nonhazardous construction waste.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Construction Waste:

a. Masonry and CMU.

b. Lumber.
c. Metals.
d. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

1.5 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan.

B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

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

B. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

    a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.3 DISPOSAL OF WASTE

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

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

B. Burning: Do not burn waste materials.

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

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificate of Insurance: For continuing coverage.

B. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

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

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
2. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
3. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

4. Submit test/adjust/balance records.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Complete startup and testing of systems and equipment.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
4. Advise Owner of changeover in heat and other utilities.
5. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
6. Complete final cleaning requirements, including touchup painting.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.

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. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

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.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.9 POST OCCUPANCY WARRANTY INSPECTIONS

A. In accordance with HUD Guidelines conduct a 9 month and 12 month post occupancy follow up warranty inspection. Coordinate attendees and document findings per HUD requirements.

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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Remove tools, construction equipment, machinery, and surplus material from Project site.
b. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
c. Sweep concrete floors broom clean in unoccupied spaces.
d. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
e. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
f. Remove labels that are not permanent.
g. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

h. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
i. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
j. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
k. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with HUD pest control requirements and Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Operation manuals for systems, subsystems, and equipment.
3. Product maintenance manuals.
4. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer Comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through GC will return three copies.

C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

   a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
   b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components

of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.

3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.

5. 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.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.

4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. 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.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

F. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Product Data.
3. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 73 00 "Execution" for final property survey.
2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints and one set of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned record prints and three set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

D. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Work Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.
    m. Field records for variable and concealed conditions.
    n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect.
    e. Name of Contractor.

2.2 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.3 MISCELLANEOUS RECORD SUBMITTALS

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

B. Format: Submit miscellaneous record submittals as PDF electronic file(s) of marked-up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

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

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

END OF SECTION 017839

SECTION 018113 – SUSTAINABLE DESIGN REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. National Green Building Standard (NGBS)
   1. 2020 NGBS for New Construction

B. A copy of the complete NGBS Scoring Checklists as appended to this document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 018113

Current Chapter level: Silver	Total Points: 90
Points away from: Bronze: 0, Silver: 0, Gold: 3, Emerald: 31	
Add'l pts earned above: Bronze: 40, Silver: 26, Gold: 0, Emerald: 0	
Total Chapter Points needed for: Bronze: 50, Silver: 64, Gold: 93, Emeral	
Revision Date: 3/28/2025	

NGBS GREEN
Home Innovation Research Labs

Coding

Practice #			Chapter 5: Lot Design, Preparation, and Development	Points Available	Points Claimed	Status	Notes
500 LOT DESIGN, PREPARATION AND DEVELOPMENT							
500.0			**500.0 Intent**. This section applies to lot development for the eventual construction of residential buildings, multifamily buildings, or additions thereto that contain dwelling units or sleeping units.				
501 LOT SELECTION							
501.1			**501.1 Lot.** Lot is selected in accordance with § 501.1(1) or § 501.1(2).		10	Certified Site:	
	(1)		A lot is selected within a site certified to this Standard or equivalent	**15**		☐	
	(2)		A lot is selected to minimize environmental impact by one or more of the following:				
		(a)	An infill lot is selected.	**10**		☑	
		(b)	A lot is selected that is a greyfield.	**10**		☐	
		(c)	An EPA-recognized brownfield lot is selected.	**15**		☐	
501.2			**501.2 Multi-modal transportation.** A range of multi-modal transportation choices are promoted by one or more of the following:				
	(1)		A lot is selected within one-half mile (805 m) of pedestrian access to a mass transit system	**6**	6	☑	MLK Jr BLVD & Cass, MLK Jr BLVD & 2nd, Cass Ave & Peterboro St
	(2)		A lot is selected within five miles (8,046 m) of a mass transit station with provisions for parking.	**3**	0	☐	
	(3)		Walkways, street crossings, and entrances designed to promote pedestrian activity are provided. New buildings are connected to existing sidewalks and areas of development.	**5**	5	☑	In plans, need to verify during inspection
	(4)		A lot is selected within one-half mile (805 m) of six or more community resources No more than two each of the following use category can be counted toward the total: Recreation, Retail, Civic, and Services. Examples of resources in each category include, but are not limited to the following: Recreation: recreational facilities (such as pools, tennis courts, basketball courts), parks. Retail: grocery store, restaurant, retail store. Civic: post office, place of worship, community center. Services: bank, daycare center, school, medical/dental office, laundromat/dry cleaners. NOTE: List the 6 community resources in the Notes field.	**4**	4	☑	Recreation: Wick Park, Cass Park Retail: Rocco's Italian Deli, Detroit K-9 Pet Supplies Civic: Masonic Temple, Comercia Bank Services: Canine to Five (pet daycare), Woodward Corridor Family Medical Center
			OR A lot is selected within a census block group that, compared to its region, has above-average neighborhood walkability using an index within the EPA's Smart Location Database:		0		
		(a)	Walkability is within the top quartile for the region.	**5**			
		(b)	Walkability is within the second quartile for the region.	**2**			
	(5)		Bicycle use is promoted by building on a lot located within a community that has rights-of-way specifically dedicated to bicycle use in the form of paved paths or bicycle lanes, or on an infill lot located within 1/2 mile of a bicycle lane designated by the jurisdiction.	**5**	0	☐	
	(6)		Dedicated bicycle parking and racks are indicated on the site plan and constructed for mixed-use and multifamily buildings:		0		
		(a)	Minimum of 1 bicycle parking space per 3 residential units	**2**			
		(b)	Minimum of 1 bicycle parking space per 2 residential units	**4**			
		(c)	Minimum of 1 bicycle parking space per 1 residential unit.	**6**			
		(d)	Bicycle enclosed storage is provided or parking spaces are covered or otherwise protected from the elements	**2 per (a)-(c)**	0	☐	
	(7)		Select a lot in a community where there is access to shared vehicle usage such as carpool drop-off areas, car-share services, and shuttle services to mass transit. NOTE: Enter name of car sharing program.	**5**	0	☐	
	(8)		Lot is within 1/2 mile walking distance of where a bike sharing program is provided. NOTE: Enter name of bike sharing program.	**5**	5	☑	MoGo Bike Share stop located in Robert R. Redmond park (0.3 mi)
502 PROJECT TEAM, MISSION STATEMENT, AND GOALS							
502.1			**502.1 Project team, mission statement, and goals.** A knowledgeable team is established and team member roles are identified with respect to green lot design, preparation, and development. The project's green goals and objectives are written into a mission statement.	**4**	4	☑	
503 LOT DESIGN							
503.0			**503.0 Intent.** The lot is designed to avoid detrimental environmental impacts first, to minimize any unavoidable impacts, and to mitigate for those impacts that do occur. The project is designed to minimize environmental impacts and to protect, restore, and enhance the natural features and environmental quality of the lot. **(Points awarded only if the intent of the design is implemented.)**				
503.1			**503.1 Natural resources.** Natural resources are conserved by one or more of the following:				
	(1)		A natural resources inventory is completed under the direction of a qualified professional.	**5**	0	☐	
	(2)		A plan is implemented to conserve the elements identified by the natural resource inventory as high-priority resources.	**6**	0	☐	
	(3)		Items listed for protection in the natural resource inventory plan are protected under the direction of a qualified professional.	**4**	0	☐	
	(4)		Basic training in tree or other natural resource protection is provided for the on-site supervisor.	**4**	0	☐	
	(5)		All tree pruning on-site is conducted by a certified arborist or other qualified professional.	**3**	0	☐	
	(6)		Ongoing maintenance of vegetation on the lot during construction is in accordance with TCIA A300 or locally accepted best practices.	**4**	0	☐	
	(7)		Where a lot adjoins a landscaped common area, a protection plan from construction activities next to the common area is implemented.	**5**	0	☐	
	(8)		Developer has a plan to design and construct the lot in accordance with the International Wildland-Urban Interface Code (IWUIC). *[Only applicable where the AHJ has not declared a wildland-urban interface area, but a fire protection engineer, certified fire marshal, or other qualified party has determined and documented the site as hazarded per the IWUIC].*	**6**	0	☐	
503.2			**503.2 Slope disturbance.** Slope disturbance is minimized by one or more of the following: Note: Points are only available for lots with slopes of 25% or greater.			Max Slope in Const. Zn:	
	(1)		The use of terrain adaptive architecture.	**5**	0	☐	
	(2)		Hydrological/soil stability study is completed and used to guide the design of all buildings on the lot.	**5**	0	☐	
	(3)		All or a percentage of driveways and parking are aligned with natural topography to reduce cut and fill.		0		
		(a)	10 percent to < 25 percent	**1**			
		(b)	25 percent to 75 percent	**4**			
		(c)	greater than 75 percent	**6**			
	(4)		Long-term erosion effects are reduced through the design and implementation of clustering, terracing, retaining walls, landscaping, or restabilization techniques.	**6**	0	☐	
	(5)		Underground parking uses the natural slope for parking entrances.	**5**	0	☐	

503.3		**503.3 Soil disturbance and erosion.** Soil disturbance and erosion are minimized by one or more of the following: (also see Section 504.3)				In plans, need to verify in practice
		Note: Points must be earned in 503.3 in order for points in 504.1 to be available				
	(1)	Construction activities are scheduled such that disturbed soil that is to be left unworked for more than 21 days is stabilized within 14 days..	**5**	5	☑	
	(2)	At least 75% of total length of the utilities on the lot are designed to use one or more alternative means:				
		(a) tunneling instead of trenching			☐	
		(b) use of smaller (low ground pressure) equipment or geomats to spread the weight of construction equipment	**5**	0	☐	
		(c) shared utility trenches or easements			☐	
		(d) placement of utilities under paved surfaces instead of yards			☐	
	(3)	Limits of clearing and grading are demarcated on the lot plan.	**5**	5	☑	
503.4		**503.4 Stormwater Management.** The stormwater management system is designed to use low impact development/green infrastructure practices to preserve, restore or mitigate changes in site hydrology due to land disturbance and the construction of impermeable surfaces through the use of one or more of the following techniques:				
		NOTE: For lots in a development, the points for 503.4 may be awarded for the lot when there is a community storm water management plan implemented and the builder does not violate that plan with respect to water leaving the lot.				
	(1)	A site assessment is conducted and a plan prepared and implemented that identifies important existing permeable soils, natural drainage ways and other water features, e.g., depressional storage, onsite to be preserved in order to maintain site hydrology.	**7**	0	☐	
	(2)	A hydrologic analysis is conducted that results in the design of a stormwater management system that maintains the pre-development (stable, natural) runoff hydrology of the site through the development or redevelopment process. Ensure that post construction runoff rate, volume and duration do not exceed predevelopment rates, volume and duration.	**10**	0	☐	
	(3)	Low Impact Development/Green infrastructure stormwater management practices to promote infiltration and evapotranspiration are used to manage rainfall on the lot and prevent the off-lot discharge of runoff from all storms up to and including the volume of following storm events:		0		
		(a) 80th percentile storm event	**5**			
		(b) 90th percentile storm event	**8**			
		(c) 95th percentile storm event	**10**			
	(4)	Permeable materials are used for driveways, parking areas, walkways, patios, and recreational surfaces and the like according to the following percentages:		0		
		(a) 10 percent to less than 25 percent (add 2 points for use of vegetative paving system)	**5**			
		(b) 25-50 percent (add 4 points for use of vegetative paving system)	**8**			
		(c) Greater than 50 percent (add 6 points for use of vegetative paving system)	**10**			
		[Points for vegetative paving systems are only awarded for locations receiving more than 20 inches per year of annual average precipitation]	**0**	0	☐	
	(5)	Complete gutter and downspout system directs storm water away from foundation to vegetated landscape area, a raingarden, or catchment system that provides for water infiltration.	**3**	3	☑	Downspouts connected to underground drainage system
503.5		**503.5 Landscape plan.** A plan for the lot is developed to limit water and energy use while preserving or enhancing the natural environment.				
		(Where "front" only or "rear" only plan is implemented, only half of the points (rounding down to a whole number) are awarded for Items (1)-(9))			full	
	(1)	A plan is formulated and implemented that protects, restores, or enhances natural vegetation on the lot.		0		
		(a) 100 percent of the natural area	**4**			
		(b) 50 percent of the natural area	**3**			
		(c) 25 percent of the natural area	**2**			
		(d) 12 percent of the natural area	**1**			
	(2)	Non-invasive vegetation that is native or regionally appropriate for local growing conditions is selected to promote biodiversity.	**7**	7	☑	
	(3)	To improve pollinator habitat, at least 10 percent of planted areas are composed of native or regionally appropriate flowering and nectar producing plant species. Invasive plant species shall not be utilized.	**3**	0	☐	
	(4)	EPA WaterSense Water Budget Tool or equivalent is used when implementing the site vegetative design.	**5**	0	☐	
	(5)	Where turf is being planted, Turfgrass Water Conservation Alliance (TWCA) or equivalent as determined by the adopting entity third party qualified water efficient grasses are used.	**3**	0	☐	
	(6)	For landscaped vegetated areas, the maximum percentage of turf area is:		0		
		(a) 0 percent	**5**			
		(b) Greater than 0 percent to less than 20 percent	**4**			
		(c) 20 percent to less than 40 percent	**3**			
		(d) 40 percent to 60 percent	**2**			
	(7)	Plants with similar watering needs are grouped (hydrozoning) and shown on the lot plan.	**5**	5	☑	verify
	(8)	Summer shading by planting installed to shade a minimum of 30 percent of building walls. To conform to summer shading, the effective shade coverage (five years after planting) is the arithmetic mean of the shade coverage calculated at 10 am for eastward facing walls, noon for southward facing walls, and 3 pm for westward facing walls on the summer solstice.	**5**	0	☐	
	(9)	Vegetative wind breaks or channels are designed to protect the lot and immediate surrounding lots as appropriate for local conditions.	**5**	0	☐	
	(10)	Site or community generated tree trimmings or stump grinding of regionally appropriate trees are used on the lot to provide protective mulch during construction or for landscaping.	**3**	0	☐	
	(11)	An integrated pest management plan is developed to minimize chemical use in pesticides and fertilizers.	**4**	0	☐	
	(12)	Developer has a plan for removal or containment of invasive plants from the disturbed areas of the site.	**3**	0	☐	
	(13)	Developer implements a plan for removal or containment of invasive plants on the undisturbed areas of the site.	**6**	0	☐	
503.6		**503.6 Wildlife habitat.** Measures are planned to support wildlife habitat and include at least two of the following:		0		
	(1)	Plants and gardens that encourage wildlife, such as bird and butterfly gardens.	**3**		☐	
	(2)	Inclusion of a certified "backyard wildlife" program.	**3**		☐	
	(3)	The lot is adjacent to a wildlife corridor, fish and game park, or preserved areas and is designed with regard for this relationship.	**3**		☐	
	(4)	Outdoor lighting techniques are utilized with regard for wildlife.	**3**		☐	
503.7		**503.7 Environmentally sensitive areas.** The lot is in accordance with one or both of the following:		4	(1)	verify
	(1)	The lot does not contain any environmentally sensitive areas that are disturbed by the construction.	**4**			
	(2)	On lots with environmentally sensitive areas, mitigation and/or restoration is conducted to preserve ecosystem functions lost through development and construction activities.	**4**			
503.8		**503.8 Demolition of existing building.** A demolition waste management plan is developed, posted at the jobsite, and implemented to recycle and/or salvage with a goal of recycling or salvaging a minimum of 50 percent of the nonhazardous demolition waste.	**5**	0		
		(One additional point awarded for every 10 percent of nonhazardous demolition waste recycled and/or salvaged beyond 50 percent).	**1 additional**			

504 LOT CONSTRUCTION

504.0		**504.0 Intent.** Environmental impact during construction is avoided to the extent possible; impacts that do occur are minimized and any significant impacts are mitigated.				
504.1		**504.1 On-site supervision and coordination.** On-site supervision and coordination is provided during on-the-lot clearing, grading, trenching, paving, and installation of utilities to ensure that specified green development practices are implemented. (also see Section 503.3) NOTE: Points must be taken in 503.3 to claim points in 504.1.	**4**	4	☑	
504.2		**504.2 Trees and vegetation.** Designated trees and vegetation are preserved by one or more of the following:				
	(1)	Fencing or equivalent is installed to protect trees and other vegetation.	**3**	0	☐	
	(2)	Trenching, significant changes in grade, and compaction of soil and critical root zones in all "tree save" areas as shown on the lot plan are avoided.	**5**	0	☐	
	(3)	Damage to designated existing trees and vegetation is mitigated during construction through pruning, root pruning, fertilizing, and watering.	**4**	0	☐	
504.3		**504.3 Soil disturbance and erosion implementation.** On-site soil disturbance and erosion are minimized by one or more of the following in accordance with the SWPPP or applicable plan: (also see Section 503.3)				
	(1)	Sediment and erosion controls are installed on the lot and maintained in accordance with the stormwater pollution prevention plan, where required.	**5**	5	☑	verify
	(2)	Limits of clearing and grading are staked out on the lot.	**5**	5	☑	verify
	(3)	"No disturbance" zones are created using fencing or flagging to protect vegetation and sensitive areas on the lot from construction activity.	**5**	0	☐	
	(4)	Topsoil from either the lot or the site development is stockpiled and stabilized for later use and used to establish landscape plantings on the lot.	**5**	0	☐	
	(5)	Soil compaction from construction equipment is reduced by distributing the weight of the equipment over a larger area (laying lightweight geogrids, mulch, chipped wood, plywood, OSB, metal plates, or other materials capable of weight distribution in the pathway of the equipment).	**4**	0	☐	
	(6)	Disturbed areas on the lot that are complete or to be left unworked for 21 days or more are stabilized within 14 days using methods as recommended by the EPA or in the approved SWPPP, where required.	**3**	0	☐	
	(7)	Soil is improved with organic amendments or mulch.	**3**	3	☑	verify
	(8)	Utilities on the lot are installed using one or more alternative means: tunneling instead of trenching, use of smaller equipment, use of low ground pressure equipment, use of geomats, shared utility trenches or easements, other. NOTE: List "other" means of installing utilities in the assigned Notes area.	**5**	0	☐ ☐ ☐ ☐ ☐ ☐	
	(9)	Inspection reports of stormwater best management practices are available.	**3**	0	☐	

505 INNOVATIVE PRACTICES

505.0		**505.0 Intent.** Innovative lot design, preparation, and development practices are used to enhance environmental performance. Waivers or variances from local development regulations are obtained and innovative zoning is used to implement such practices.				
505.1		**505.1 Driveways and parking areas.** Driveways and parking areas are minimized or mitigated by one or more of the following:				
	(1)	Off-street parking areas are shared or driveways are shared. Waivers or variances from local development regulations are obtained to implement such practices, if required.	**5**	5	☑	
	(2)	In a multifamily project, parking capacity does not exceed the local minimum requirements.	**5**	5	☑	On-site parking has 14 spaces of 37 required
	(3)	Structured parking is utilized to reduce the footprint of surface parking areas.		0		
	(a)	25 percent to less than 50 percent	**4**			
	(b)	50 percent to 75 percent	**5**			
	(c)	greater than 75 percent	**6**			
505.2		**505.2 Heat island mitigation.** Heat island effect is mitigated by the following.				
	(1)	Hardscape: Not less than 50 percent of the surface area of the hardscape on the lot meets one or a combination of the following methods.	**5**	0		
	(a)	Shading of hardscaping: Shade is provided from existing or new vegetation (within five years) or from trellises. Shade of hardscaping is to be measured on the summer solstice at noon.			☐	
	(b)	Light-colored hardscaping: Horizontal hardscaping materials are installed with a solar reflectance index (SRI) of 29 or greater. The SRI is calculated in accordance with ASTM E1980. A default SRI value of 35 for new concrete without added color pigment is permitted to be used instead of measurements.			☐	
	(c)	Permeable hardscaping: Permeable hardscaping materials are installed.			☐	
	(2)	Roofs: Not less than 75 percent of the exposed surface of the roof is vegetated using technology capable of withstanding the climate conditions of the jurisdiction and the microclimate conditions of the building lot. Invasive plant species are not permitted.	**5**	0	☐	
505.3		**505.3 Density.** The average density on the lot on a net developable area basis is:		0		49 units / 0.65 acres = 75.38 units / acre
	(1)	7 to less than 14 dwelling units/sleeping units per acre (per 4,047 m2)	**4**			
	(2)	14 to less than 21 dwelling units/sleeping units per acre (per 4,047 m2)	**5**			
	(3)	21 to less than 35 dwelling units/sleeping units per acre (per 4,047 m2)	**6**			
	(4)	35 to less than 70 dwelling units/sleeping units per acre (per 4,047 m2)	**7**			
	(5)	70 or greater dwelling units/sleeping units per acre (per 4,047 m2)	**8**			
505.4		**505.4 Mixed-use development.**				
	(1)	The lot contains a mixed-use building.	**8**	0	☐	
505.5		**505.5 Multifamily & mixed-use community garden(s).** A portion of the lot is established as a community garden(s), available to residents of the lot, to provide for local food production to residents or area consumers.			Community Garden (sf):	
	(a)	A portion of the lot of at least 250 sq ft is established as community garden(s) for the residents of the site. [*3 points per 250 sq ft]	**9 max**	0		
	(b)	Locate the project within a 0.5-mile walking distance of an existing or planned farmers market/ farm stand that is open or will operate at least once a week for at least five months of the year.	**3**	0	☐	
	(c)	Areas and physical provisions are provided for composting.	**1**	0	☐	
	(d)	Signs designating the garden area are posted.	**1**	0	☐	
505.6		**505.6 Multi-Unit Plug-In Electric Vehicle Charging.** Plug-in electric vehicle charging capability is provided for not fewer than 2 percent of parking stalls. [An additional 2 points can be earned for each percentage point above 2% for a maximum of 10 points] Fractional values shall be rounded up to the nearest whole number. Electrical capacity in main electric panels supports Level 2 charging (208/240V- up to 80 amps or in accordance with SAE J1772). Each stall is provided with conduit and wiring infrastructure from the electric panel to support Level 2 charging (208/240V- up to 80 amps or in accordance with SAE J1772) service to the designated stalls, and stalls are equipped with either Level 2 charging AC grounded outlets (208/240V- up to 80 amps or in accordance with SAE J1772) or Level 2 charging stations (208/240V- up to 80 amps or in accordance with SAE J1772) by a third party charging station. NOTE: SF/BTR homes are also eligible if 2% or more of the total of shared/communal/visitor parking stalls in the development/community have plug-in electric vehicle charging capability.	**4 (10 max)**	0		

505.7		**505.7 Multi-unit residential CNG vehicle fueling.** CNG vehicle residential fueling appliances are provided for at least 1 percent of the parking stalls. The CNG fueling appliances shall be listed in accordance with ANSI/CSA NGV 5.1 and installed in accordance with the appliance manufacturer's installation instructions. NOTE: Single-Family/Build-to-Rent homes are also eligible if 1% of the shared/communal/visitor parking stalls in the development have residential CNG vehicle refueling.	**4**	0	☐	
505.8		**505.8 Street network.** Locate the project in an area of high intersection density.	**5**	0	☐	87
505.9		**505.9 Smoking prohibitions.** Signs are provided on multifamily and mixed-use lots prohibiting smoking at the following locations: NOTE: Build-to-rent homes are also eligible for (a), (b) and (c) if smoking is prohibited and signs posted for all homes in the development/community. SF homes for sale are not eligible.			Build-to-Rent? ☐	
	(a)	Smoking is prohibited within 25 feet (7.5 m) of all building exterior doors and operable windows or building air intakes within 15 (4.5 m) vertical feet of grade or a walking surface.	**3**	0	☐	
	(b)	Smoking is prohibited on decks, balconies, patios and other occupied exterior spaces.	**3**	0	☐	
	(c)	Smoking is prohibited at all parks, playgrounds, and community activity or recreational spaces.	**3**	0	☐	
505.10		**505.10 Exercise & Recreation Area.** For multifamily buildings, on-site dedicated recreation space for exercise or play opportunities for adults and/or children open and accessible to residents is provided.				
	(a)	A dedicated area of at least 400 square feet is provided inside the building with adult exercise and/or children's play equipment.	**3**	0	☐	
	(b)	A courtyard, garden, terrace, or roof space at least 10% of the lot area that can serve as outdoor space for children's play and /or adult activities is provided.	**3**	0	☐	
	(c)	Active play/recreation areas are illuminated at night to extend opportunities for physical activity into the evening.	**3**	0	☐	
END OF CHAPTER 5						CLICK TO PROCEED TO CHAPTER 6 >>

		Current Chapter level: Silver	**Total Points: 81**			
		Points away from: Bronze: 0, Silver: 0, Gold: 8, Emerald: 38				
		Add'l pts earned above: Bronze: 38, Silver: 22, Gold: 0, Emerald: 0				
		Total Chapter Points needed for: Bronze: 43, Silver: 59, Gold: 89, Emera				
		Revision Date: 3/28/2025				
Coding	Practice #	Chapter 6: Resource Efficiency	Points Available	Points Claimed	Status	Notes
		601 QUALITY OF CONSTRUCTION MATERIALS AND WASTE				
	601.0	**601.0 Intent.** Design and construction practices that minimize the environmental impact of the building materials are incorporated, environmentally efficient building systems and materials are incorporated, and waste generated during construction is reduced.				
	601.1	**601.1 Conditioned floor area.** Finished floor area of a dwelling unit or sleeping unit is limited. Finished floor area is calculated in accordance with ANSI Z765 for single family and ANSI/BOMA Z65.4 for multifamily buildings. Only the finished floor area for stories above grade plane is included in the calculation. [For every 100 square feet (9.29 m2) over 4,000 square feet (372 m2), one point is to be added to rating level points shown in Table 303, Category 7 for each rating level.]		9		
	(1)	less than or equal to 700 square feet (65 m^2)	**14**			
	(2)	less than or equal to 1,000 square feet (93 m^2)	**12**			
	(3)	less than or equal to 1,500 square feet (139 m^2)	**9**			
	(4)	less than or equal to 2,000 square feet (186 m^2)	**6**			
	(5)	less than or equal to 2,500 square feet (232 m^2)	**3**			
	(6)	greater than 4,000 square feet (372 m^2)	**N/A**			
		(For every 100 square feet (9.29 m^2) over 4,000 square feet (372 m^2), one point is to be added to rating level points shown in Table 303, Category 7 for each rating level.)				
		Multifamily Building Note: For a multifamily building, a weighted average of the individual unit sizes is used for this practice.				
	601.2	**601.2 Material usage.** Structural systems are designed or construction techniques are implemented that reduce and optimize material usage.				
	(1)	Minimum structural member or element sizes necessary for strength and stiffness in accordance with advanced framing techniques or structural design standards are selected.	**3**	0	☐	
	(2)	Higher-grade or higher-strength of the same materials than commonly specified for structural elements and components in the building are used and element or component sizes are reduced accordingly.	**3**	0	☐	
	(3)	Performance-based structural design is used to optimize lateral force-resisting systems.	**3**	0	☐	
	601.3	**601.3 Building dimensions and layouts.** Building dimensions and layouts are designed to reduce material cuts and waste. This practice is used for a minimum of 80 percent of the following areas:				
	(1)	floor area	**3**	3	☑	shop fab
	(2)	wall area	**3**	0	☐	
	(3)	roof area	**3**	3	☑	prefab roof truss
	(4)	cladding or siding area	**3**	0	☐	
	(5)	penetrations or trim area	**1**	0	☐	
	601.4	**601.4 Framing and structural plans.** Detailed framing or structural plans, material quantity lists and on-site cut lists for framing, structural materials, and sheathing materials are provided.	**4**	0	☐	
	601.5	**601.5 Prefabricated components.** Precut or preassembled components, or panelized or precast assemblies are utilized for a minimum of 90 percent for the following system or building:	**13 Max**			
	(1)	floor system	**4**	4	☑	shop fab
	(2)	wall system	**4**	0	☐	
	(3)	roof system	**4**	4	☑	prefab roof truss
	(4)	modular construction for the entire building located above grade	**13**	0	☐	
	(5)	manufactured home construction for the entire building located above grade	**13**	0	☐	
	601.6	**601.6 Stacked stories.** Stories above grade are stacked, such as in 1½-story, 2-story, or greater structures. The area of the upper story is a minimum of 50 percent of the area of the story below based on areas with a minimum ceiling height of 7 feet (2,134 mm).	**8 Max**	8	from overview: 4+ story bldg.	
	(1)	first stacked story	**4**			
	(2)	for each additional stacked story	**2**			
	601.7	**601.7 Prefinished materials. Prefinished building** materials or assemblies listed below have no additional site-applied finishing material are installed.	**12 Max**	3		Brick, prefinished fiber cement panels
		(Points awarded for each type of material or assembly.)				
	(a)	interior trim not requiring paint or stain				
	(b)	exterior trim not requiring paint or stain			50% to less than 90%	
	(c)	window, skylight, and door assemblies not requiring paint or stain on one of the following surfaces:			35% to less than 50%	
		i. exterior surfaces				
		ii. interior surfaces				
	(d)	interior wall coverings or systems, floor systems, and/or ceiling systems not requiring paint or stain or other type of finishing application				
	(e)	exterior wall coverings or systems, floor system, and/or ceiling systems not requiring paint or stain or other type of finishing application				
	(1)	90 percent or more of the installed building materials or assemblies listed above:	**5**			
	(2)	50 percent to less than 90 percent of the installed building material or assembly listed above:	**2**			
	(3)	35 percent to less than 50 percent of the installed building material or assembly listed above:	**1**			
	601.8	**601.8 Foundations.** A foundation system that minimizes soil disturbance, excavation quantities, and material usage, such as frost-protected shallow foundations, isolated pier and pad foundations, deep foundations, post foundations, or helical piles is selected, designed, and constructed. The foundation is used on 50 percent or more of the building footprint.	**3**	0	☐	
		NOTE: Indicate in the assigned Notes area the type designed and constructed: frost-protected shallow foundations, pier and pad foundations, post foundations, or other similar foundation type.				

602 ENHANCED DURABILITY AND REDUCED MAINTENANCE

602.0		**602.0 Intent.** Design and construction practices are implemented that enhance the durability of materials and reduce in-service maintenance.				
602.1		**602.1 Moisture Management – Building Envelope**				
602.1.1		**602.1.1 Capillary breaks**				
602.1.1.1		**602.1.1.1** A capillary break and vapor retarder are installed at concrete slabs in accordance with ICC IRC Sections R506.2.2 and R506.2.3 or ICC IBC Sections 1907 and 1805.4.1.	Mandatory		Met	
602.1.1.2		**602.1.1.2** A capillary break between the footing and the foundation wall is provided to prevent moisture migration into foundation wall.	3	0	☐	
602.1.2		**602.1.2 Foundation waterproofing.** Enhanced foundation waterproofing is installed using one or both of the following:	4	0		
	(1)	rubberized coating, or			☐	
	(2)	drainage mat			☐	
602.1.3		**602.1.3 Foundation drainage**				
602.1.3.1		**602.1.3.1** Where required by the ICC IRC or IBC for habitable and usable spaces below grade, exterior drain tile is installed.	N/A		☐	
602.1.3.2		**602.1.3.2** Interior and exterior foundation perimeter drains are installed and sloped to discharge to daylight, dry well, or sump pit.	4	0	☐	
602.1.4		**602.1.4 Crawlspaces**				
602.1.4.1		**602.1.4.1** Vapor retarder in unconditioned vented crawlspace is in accordance with the following, as applicable. Joints of vapor retarder overlap a minimum of 6 inches (152 mm) and are taped.				
	(1)	Floors. Minimum 6 mil vapor retarder installed on the crawlspace floor and extended at least 6 inches up the wall and is attached and sealed to the wall.	6	0	☐	
	(2)	Walls. Dampproof walls are provided below finished grade.	N/A			
602.1.4.2		**602.1.4.2** Crawlspace that is built as a conditioned area is sealed to prevent outside air infiltration and provided with conditioned air at a rate not less than 0.02 cfm (.009 L/s) per square foot of horizontal area and one of the following is implemented:				
	(1)	a concrete slab over 6 mil polyethylene sheeting. Or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the International Residential Code	8	0	☐	
	(2)	6 mil polyethylene sheeting, or other Class I vapor retarder installed in accordance with Section 408.3 or Section 506 of the International Residential Code	N/A			
602.1.5		**602.1.5 Termite barrier.** Continuous physical foundation termite barrier provided: See Figure 6(3)			termite infest. prob.:	
	(1)	In geographic areas that have moderate to heavy infestation potential in accordance with figure 6(3), a no or low toxicity treatment is also installed.	4	0	☐	
	(2)	In geographic areas that have a very heavy infestation potential in accordance with figure 6(3), in addition a low toxicity bait and kill termite treatment plan is selected and implemented.	4	0	☐	
602.1.6		**602.1.6 Termite-resistant materials.** In areas of termite infestation probability as defined by Figure 6(3), termite-resistant materials are used as follows: See Figure 6(3)				
	(1)	In areas of slight to moderate termite infestation probability: for the foundation, all structural walls, floors, concealed roof spaces not accessible for inspection, exterior decks, and exterior claddings within the first 2 feet (610 mm) above the top of the foundation.	2	0	☐	
	(2)	In areas of moderate to heavy termite infestation probability: for the foundation, all structural walls, floors, concealed roof spaces not accessible for inspection, exterior decks, and exterior claddings within the first 3 feet (914 mm) above the top of the foundation.	4	0	☐	
	(3)	In areas of very heavy termite infestation probability: for the foundation, all structural walls, floors, concealed roof spaces not accessible for inspection, exterior decks, and exterior claddings.	6	0	☐	
602.1.7		**602.1.7 Moisture control measures**				
602.1.7.1		**602.1.7.1** Moisture control measures are in accordance with the following:				
	(1)	Building materials with visible mold are not installed or are cleaned or encapsulated prior to concealment and closing.	2	2	☑	to be verified at rough
	(2)	Insulation in cavities is dry in accordance with manufacturer's instructions when enclosed (e.g., with drywall). NOTE: If "N/A" is selected, explain why in the assigned Notes area.	Mandatory 2	2	Met	to be verified at rough
	(3)	The moisture content of lumber is sampled to ensure it does not exceed 19 percent prior to the surface and/or cavity enclosure.	4	4	☑	to be verified at rough
602.1.7.2		**602.1.7.2** Moisture content of subfloor, substrate, or concrete slabs is in accordance with the appropriate industry standard for the finish flooring to be applied.	2	2	☑	to be verified at rough
602.1.7.3		**602.1.7.3** Building envelope assemblies are designed for moisture control based on documented hygrothermal simulation or field study analysis. Hygrothermal analysis is required to incorporate representative climatic conditions, interior conditions and include heating and cooling seasonal variation.	4	0	☐	
602.1.8		**602.1.8 Water-resistive barrier.** Where required by the ICC, IRC, or IBC, a water-resistive barrier and/or drainage plane system is installed behind exterior veneer and/or siding. NOTE: If "N/A" is selected, explain why in the assigned Notes area.	Mandatory		Met	
602.1.9		**602.1.9 Flashing.** Flashing is provided as follows to minimize water entry into wall and roof assemblies and to direct water to exterior surfaces or exterior water-resistive barriers for drainage. Flashing details are provided in the construction documents and are in accordance with the fenestration manufacturer's instructions, the flashing manufacturer's instructions, or as detailed by a registered design professional.				
	(1)	Flashing is installed at all of the following locations, as applicable: **(a)** around exterior fenestrations, skylights, and doors **(b)** at roof valleys **(c)** at all building-to-deck, -balcony, -porch, and -stair intersections **(d)** at roof-to-wall intersections, at roof-to-chimney intersections, at wall-to-chimney intersections, and at parapets **(e)** at ends of and under masonry, wood, or metal copings and sills **(f)** above projecting wood trim **(g)** at built-in roof gutters, and **(h)** drip edge is installed at eave and rake edges.	Mandatory		☑	
	(2)	All window and door head and jamb flashing is either self-adhered flashing complying with AAMA 711-13 or liquid applied flashing complying with AAMA 714-15 and installed in accordance with fenestration or flashing manufacturer's installation instructions.	2	2	☑	
	(3)	Pan flashing is installed at sills of all exterior windows and doors.	3	0	☐	
	(4)	Seamless, preformed kickout flashing, or prefabricated metal with soldered seams is provided at all roof-to-wall intersections. The type and thickness of the material used for roof flashing including but not limited kickout and step flashing is commensurate with the anticipated service life of the roofing material.	3	0	☐	
	(5)	A rainscreen wall design as follows is used for exterior wall assemblies		0		
	(a)	a system designed with minimum 1/4-inch air space exterior to the water-resistive barrier, vented to the exterior at top and bottom of the wall, and integrated with flashing details. OR	4			
	(b)	a cladding material or a water-resistive barrier with enhanced drainage, meeting 75 percent drainage efficiency determined in accordance with ASTM E2273.	2			
	(6)	Through-wall flashing is installed at transitions between wall cladding materials or wall construction types.	2	2	☑	
	(7)	Flashing is installed at expansion joints in stucco walls.	2	0	☐	

602.1.10		**602.1.10 Exterior doors.** Entries at exterior door assemblies, inclusive of side lights (if any), are covered by one of the following methods to protect the building from the effects of precipitation and solar radiation. Either a storm door or a projection factor of 0.375 minimum is provided. Eastern- and western-facing entries in Climate Zones 1, 2, and 3, as determined in accordance with Figure 6(1) or Appendix A, have either a storm door or a projection factor of 1.0 minimum, unless protected from direct solar radiation by other means (e.g., screen wall, vegetation). This Project's Climate Zone: 5	**2 per exterior door** **6 Max**	2	1 exterior door	
	(a)	installing a porch roof or awning				
	(b)	extending the roof overhang				
	(c)	recessing the exterior door				
	(d)	Installing a storm door				
		Note: The pedestrian door protected in a garage leading to living space does not qualify for points.				
602.1.11		**602.1.11 Tile backing materials.** Tile backing materials installed under tiled surfaces in wet areas are in accordance with ASTM C1178, C1278, C1288, or C1325.	**Mandatory**		Met	
602.1.12		**602.1.12 Roof overhangs.** Roof overhangs, in accordance with Table 602.1.12, are provided over a minimum of 90 percent of exterior walls to protect the building envelope. See Table 602.1.12	**4**	0	☐	
602.1.13		**602.1.13 Ice barrier.** In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier is installed in accordance with the ICC IRC or IBC at roof eaves of pitched roofs and extends a minimum of 24 inches (610 mm) inside the exterior wall line of the building.	**Mandatory**		N/A	Flat roof
602.1.14		**602.1.14 Architectural features**. Architectural features that increase the potential for water intrusion are avoided:				
	(1)	All horizontal ledgers are sloped away to provide gravity drainage as appropriate for the application.	**Mandatory** **1**	1	Met	
	(2)	No roof configurations that create horizontal valleys in roof design.	**2**	2	☑	
	(3)	No recessed windows and architectural features that trap water on horizontal surfaces.	**2**	0	☐	
602.1.15		**602.1.15 Kitchen and vanity cabinets.** All kitchen and vanity cabinets are certified in accordance with the ANSI/KCMA A161.1 performance standard or equivalent. NOTE: Identify what product was used in the assigned Notes area.	**2**	0	☐	
602.2		**602.2 Roof surfaces.** A minimum of 90 percent of roof surfaces, not used for roof penetrations and associated equipment, on-site renewable energy systems such as photovoltaics or solar thermal energy collectors, or rooftop decks, amenities and walkways, are constructed of one or more of the following:	**3**	3		
	(1)	products that are in accordance with the ENERGY STAR® cool roof certification or equivalent			☑	Scope says intent is to have ES product, verify
	(2)	a vegetated roof system			☐	
	(3)	Minimum initial SRI of 78 for low-sloped roof (a slope less than 2:12) and a minimum initial SRI of 29 for a steep-sloped roof (a slope equal to or greater than 2:12). The SRI is calculated in accordance with ASTM E1980. Roof products are certified and labeled.			☐	
602.3		**602.3 Roof water discharge.** A gutter and downspout system or splash blocks and effective grading are provided to carry water a minimum of 5 feet (1524 mm) away from perimeter foundation walls.	**4**	4	☑	verify
602.4		**602.4 Finished grade.**				
602.4.1		**602.4.1** Finished grade at all sides of a building is sloped to provide a minimum of 6 inches (150 mm) of fall within 10 feet (3048 mm) of the edge of the building. Where lot lines, walls, slopes, or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), the final grade is sloped away from the edge of the building at a minimum slope of 2 percent.	**Mandatory**		☑	
602.4.2		**602.4.2** The final grade is sloped away from the edge of the building at a minimum slope of 5 percent.	**1**	0	☐	
602.4.3		**602.4.3** Water is directed to drains or swales to ensure drainage away from the structure.	**1**	0	☐	
603 REUSED OR SALVAGED MATERIALS						
603.0		**603.0 Intent.** Practices that reuse or modify existing structures, salvage materials for other uses, or use salvaged materials in the building's construction are implemented.				
603.1		**603.1 Reuse of existing building.** Major elements or components of existing buildings and structures are reused, modified, or deconstructed for later use. **(Points awarded for every 200 square feet (18.5 m^2) of floor area.)** NOTE: Describe materials used in the assigned Notes area. Materials, elements, or components awarded points under Section 603.1 shall not be awarded points under Section 603.2.	**1** **12 Max**	0		
603.2		**603.2 Salvaged materials.** Reclaimed and/or salvaged materials and components are used. The total material value and labor cost of salvaged materials is equal to or exceeds 1 percent of the total construction cost. **(Points awarded per 1% of salvaged materials used based on the total construction cost.)** NOTE: Describe materials used in the assigned Notes area. Materials, elements, or components awarded points under Section 603.1 shall not be awarded points under Section 603.2.	**1** **9 Max**	0		
603.3		**603.3 Scrap materials.** Sorting and reuse of scrap building material is facilitated (e.g., a central storage area or dedicated bins are provided). NOTE: Indicate in the assigned Notes area what salvage materials were sorted for reuse.	**4**	0	☐	
604 RECYCLED-CONTENT BUILDING MATERIALS						
604.1		**604.1 Recycled content.** Building materials with recycled content are used for two minor and/or two major components of the building. Enter material percent recycled content. See Table 604.1 NOTE: In the assigned Notes area, list materials used for minor and/or major building components.	**per Table 604.1**	0	First Minor Comp.: Second Minor Comp.: First Major Comp.: Second Major Comp.:	
605 RECYCLED CONSTRUCTION WASTE						
605.0		**605.0 Intent.** Waste generated during construction is recycled.				
605.1		**605.1 Hazardous waste.** The construction and waste management plan shall include information on the proper handling and disposal of hazardous waste. Hazardous waste is properly handled and disposed.	**Mandatory**		☑	verify
605.2		**605.2 Construction waste management plan.** A construction waste management plan is developed, posted at the jobsite, and implemented diverting, through reuse, salvage, recycling, or manufacturer reclamation, a minimum of 50 percent (by weight) of nonhazardous construction and demolition waste from disposal. For this practice, land clearing debris is not considered construction waste. Materials used as alternative daily cover are considered construction waste and do not count toward recycling or salvaging. For buildings following the new construction path that also have a renovation component, the waste management plan includes the recycling of 95 percent of electronic waste components (such as printed circuit boards from computers, building automation systems, HVAC, fire and security control boards) by an E-Waste recycling facility. **Exceptions:**	**6**	0	☐	
	(1)	Waste materials generated from land clearing, soil and sub-grade excavation and vegetative debris shall not be in the calculations.				
	(2)	A recycling facility (traditional or E-Waste) offering material receipt documentation is not available within 50 miles of the jobsite.			☐	

605.3		**605.3 On-site recycling.** On-site recycling measures following applicable regulations and codes are implemented, such as the following:	**7**	0	☐	
	(a)	Materials are ground or otherwise safely applied on-site as soil amendment or fill. A minimum of 50 percent (by weight) of construction and land-clearing waste is diverted from landfill.				
	(b)	Alternative compliance methods approved by the Adopting Entity.				
	(c)	Compatible untreated biomass material (lumber, posts, beams, etc.) are set aside for combustion if a solid fuel-burning appliance per Section 901.2.1(2) will be available for on-site renewable energy.				
605.4		**605.4 Recycled construction materials.** Construction materials (e.g., wood, cardboard, metals, drywall, plastic, asphalt roofing shingles, or concrete) are recycled offsite.	**6 Max**	0		
	(1)	a minimum of two types of materials are recycled	**3**			
	(2)	for each additional recycled material type	**1**			
	(a)	wood			☐	
	(b)	cardboard			☐	
	(c)	metals			☐	
	(d)	drywall			☐	
	(e)	plastic			☐	
	(f)	asphalt roofing shingles			☐	
	(g)	concrete			☐	
	(h)	other			☐	
	(i)	other			☐	
		NOTE: List "other" types of materials recycled in the assigned Notes area.				

606 RENEWABLE MATERIALS

606.0		**606.0 Intent.** Building materials derived from renewable resources are used.				
606.1		**606.1 Biobased products.** The following biobased products are used:				
	(a)	certified solid wood in accordance with Section 606.2				
	(b)	engineered wood				
	(c)	bamboo				
	(d)	cotton				
	(e)	cork		0		
	(f)	straw				
	(g)	natural fiber products made from crops (soy-based, corn-based)				
	(h)	other biobased materials with a minimum of 50 percent biobased content (by weight or volume)				
		Note: Please list "other biobased materials" used in the Notes field				
	(1)	Two types of biobased materials are used, each for more than 0.5 percent of the project's projected building material cost.	**3**			
	(2)	Two types of biobased materials are used, each for more than 1 percent of the project's projected building material cost.	**6**			
	(3)	For each additional biobased material used for more than 0.5 percent of the project's projected building material cost.	**1** **2 Max**			
606.2		**606.2 Wood-based products.** Wood or wood-based products are certified to the requirements of one of the following:				
	(a)	American Forest Foundation's *American Tree Farm System®* (ATFS)				
	(b)	Canadian Standards Association's *Sustainable Forest Management System Standards* (CSA Z809)				
	(c)	*Forest Stewardship Council* (FSC)				
	(d)	*Program for Endorsement of Forest Certification Systems* (PEFC)				
	(e)	*Sustainable Forestry Initiative ® Program (SFI)*				
	(f)	National Wood Flooring Association's Responsible Procurement Program (RPP)				
	(g)	other product programs mutually recognized by PEFC				
	(h)	A manufacturer's fiber procurement system that has been audited by an approved agency as compliant with the provisions of ASTM D7612 as a responsible or certified source. Government or tribal forestlands whose water protection programs have been evaluated by an approved agency as compliant with the responsible source designation of ASTM D7612 are exempt from auditing in the manufacturers' fiber procurement system.			Program(s):	
	(1)	A minimum of two responsible or certified wood-based products are used for minor components of the building.	**3**	0		
		Note: Please list products and components in the Notes fields				
	(2)	A minimum of two responsible or certified wood-based products are used in major components of the building.	**4**	0		
		Note: Please list products and components in the Notes fields				
606.3		**606.3 Manufacturing energy.** Materials manufactured using a minimum of 33 percent of the primary manufacturing process energy derived from (1) renewable sources, (2) combustible waste sources, or (3) renewable energy credits (RECs) are used for major components of the building. **(2 points awarded per material.)**	**6 Max**	0		
		Note: Please list materials in the Notes field				

607 RECYCLING AND WASTE REDUCTION

607.1		**607.1 Recycling and composting.** Recycling and composting by the occupant are facilitated by one or more of the following methods:				
	(1)	A readily accessible space(s) for recyclable material containers is provided and identified on the floorplan of the house or dwelling unit or a readily accessible area(s) outside the living space is provided for recyclable material containers and identified on the site plan for the house or building. The area outside the living space shall accommodate recycling bin(s) for recyclable materials accepted in local recycling programs.	**2**	0	☐	
	(2)	A readily accessible space(s) for compostable material containers is provided and identified on the floorplan of the house or dwelling unit or a readily accessible area(s) outside the living space is provided for compostable material containers and identified on the site plan for the house or building. The area outside the living space shall accommodate composting container(s) for locally accepted materials, or, accommodate composting container(s) for on-site composting.	**4**	0	☐	
607.2		**607.2 Food waste disposers.** A minimum of one food waste disposer is installed at the primary kitchen sink.	**1**	1	☑	garbage disposal in plans

608 RESOURCE-EFFICIENT MATERIALS

608.1		**608.1 Resource-efficient materials.** Products containing fewer materials are used to achieve the same end-use requirements as conventional products, including but not limited to:			2 products	roof and floor truss
	(1)	lighter, thinner brick with bed depth less than 3 inches and/or brick with coring of more that 25 percent	**9 Max** **3 per material**	6		
	(2)	engineered wood or engineered steel products				
	(3)	roof or floor trusses				
		NOTE: In the assigned Notes area, describe the types of products that comply with 608.1.				

609 REGIONAL MATERIALS

609.1 **609.1 Regional materials.** Regional materials are used for major and/or minor components of the building. — **10 Max**

# of major components:

(1) Major component — **2 per each component** — 0

# of minor components:

(2) Minor component — **1 per each component**

For a component to comply with this practice, a minimum of 75 percent of all products in that component category must be sourced regionally, e.g., stone veneer category – 75 percent or more of the stone veneer on a project must be sourced regionally.

NOTE: In the assigned Notes areas, list major and minor materials used that comply with 609.1.

610 LIFE CYCLE ASSESSMENT

610.1 **610.1 Life cycle assessment.** A life cycle assessment (LCA) tool is used to select environmentally preferable products, assemblies, or, entire building designs. Points are awarded in accordance with Section 610.1.1 or 610.1.2. Only one method of analysis or tool may be utilized. The reference service life for the building is 60 years for any life cycle analysis tool. Results of the LCA are reported in the manual required in Section 1001.1 or 1002.1(1) of this Standard in terms of the environmental impacts listed in this practice and it is stated if operating energy was included in the LCA.

NOTE: Identify the LCA tool utilized and the person who completed the analysis.

610.1.1 **610.1.1 Whole-building life cycle assessment.** A whole-building LCA is performed in conformance with ASTM E2921 using ISO14044 compliant life cycle assessment.

(1) Execute LCA at the whole building level through a comparative analysis between the final and reference building designs as set forth under Standard Practice, ASTM E2921. The assessment criteria includes the following environmental impact categories: — ☐ — **8** — 0

- **(a)** Primary energy use
- **(b)** Global warming potential
- **(c)** Acidification potential
- **(d)** Eutrophication potential
- **(e)** Ozone depletion potential
- **(f)** Smog potential

(2) Execute LCA on regulated loads throughout the building operations life cycle stage. Conduct simulated energy performance analyses in accordance with Section 702.2.1 ICC IECC analysis (IECC Section 405) in establishing the comparative performance of final versus reference building designs. Primary energy use savings and global warming potential avoidance from simulation analyses results are determined using energy supplier, utility, or EPA electricity generation and other fuels energy conversion factors and electricity generation and other fuels emission rates for the locality or Sub-Region in which the building is located — ☐ — **5** — 0

(3) Execute full LCA, including use-phase, through calculation of operating energy impacts (c) – (f) using local or regional emissions factors from energy supplier, utility, or EPA. — ☐ — **2** — 0

610.1.2 **610.1.2 Life cycle assessment for a product or assembly.** An environmentally preferable product or assembly is selected for an application based upon the use of an LCA tool that incorporates data methods compliant with ISO 14044 or other recognized standards that compare the environmental impact of products or assemblies. — **10 Max** — 0

610.1.2.1 **610.1.2.1 Product LCA.** A product with improved environmental impact measures compared to another product(s) intended for the same use is selected. The environmental impact measures used in the assessment are selected from the following:

- **(a)** Primary energy use
- **(b)** Global warming potential
- **(c)** Acidification potential
- **(d)** Eutrophication potential
- **(e)** Ozone depletion potential
- **(f)** Smog potential

(Points are awarded for each product/system comparison where the selected product/system improved upon the environmental impact measures by an average of 15 percent.)

NOTE: List products/systems compared & impact measures considered in the assigned Notes area.

per Table 610.1.2.1 10 Max

# of comparisons with 4 measures:

# of comparisons with 5 measures:

610.1.2.2 **610.1.2.2 Building assembly LCA.** A building assembly with improved environmental impact measures compared to an alternative assembly of the same function is selected. The full life cycle, from resource extraction to demolition and disposal (including but not limited to on-site construction, maintenance and replacement, material and product embodied acquisition, and process and transportation energy), is assessed. The assessment includes all structural elements, insulation, and wall coverings of the assembly. The assessment does not include electrical and mechanical equipment and controls, plumbing products, fire detection and alarm systems, elevators, and conveying systems. The following types of building assemblies are eligible for points under this practice:

- **(a)** exterior walls
- **(b)** roof/ceiling
- **(c)** interior walls or ceilings
- **(d)** intermediate floors

The environmental impact measures used in the assessment are selected from the following:

- **(a)** Primary energy use
- **(b)** Global warming potential
- **(c)** Acidification potential
- **(d)** Eutrophication potential
- **(e)** Ozone depletion potential
- **(f)** Smog potential

(Points are awarded based on the number of types of building assemblies that improve upon environmental impact measures by an average of 15 percent.)

NOTE: List assemblies compared & impact measures considered in the assigned Notes area.

per Table 610.1.2.2 10 Max

exterior walls:

roof/ceiling:

int. walls or ceilings:

intermediate floors:

611 PRODUCT DECLARATIONS

611.1	**611.1 Product declarations.** A minimum of 10 different products installed in the building project, at the time of certificate of occupancy, comply with one of the following sub-sections. Declarations, reports, and assessments are submitted and contain documentation of the critical peer review by an independent third party, results from the review, the reviewer's name, company name, contact information, and date of the review.	**5**	0		
611.1.1	**611.1.1 Industry-wide declaration.** A Type III industry-wide environmental product declaration (EPD) is submitted for each product. Where the program operator explicitly recognizes the EPD as representative of the product group on a National level, it is considered industry-wide. In the case where an industry-wide EPD represents only a subset of an industry group, as opposed to being industry-wide, the manufacturer is required be explicitly recognized as a participant by the EPD program operator. All EPDs are required to be consistent with ISO Standards 14025 and 21930 with at least a cradle-to-gate scope. **(Each product complying with Section 611.1.1 shall be counted as one product for compliance with Section 611.1.)** NOTE: List products in the assigned Notes area.			# of products:	
611.1.2	**611.1.2 Product Specific Declaration.** A product specific Type III EPD are submitted for each product. The product specific declaration shall be manufacturer specific for an individual product or product family. All Type III EPDs are required to be certified as complying, at a minimum, with the goal and scope for the cradle-to-gate requirements in accordance with ISO Standards 14025 and 21930. **(Each product complying with Section 611.1.2 shall be counted as two products for compliance with Section 611.1.)** NOTE: List products in the assigned Notes area.			# of products (not effective number):	

612 INNOVATIVE PRACTICES

612.1	**612.1 Manufacturer's environmental management system concepts.** Product manufacturer's operations and business practices include environmental management system concepts, and the production facility is registered to ISO 14001 or equivalent. The aggregate value of building products from registered ISO 14001 or equivalent production facilities is 1 percent or more of the estimated total building materials cost. **(1 point awarded per percent.)** NOTE: In the assigned Notes area, list products that comply with manufacturers and ISO registrars.	**10 Max**	0		
612.2	**612.2 Sustainable products.** One or more of the following products are used for at least 30% of the floor or wall area of the entire dwelling unit or the sleeping unit, as applicable. Products are certified by a third-party agency accredited to ISO 17065.	**9 Max**	0		
(1)	50% or more of carpet installed (by square feet) is certified to NSF 140 or equivalent.	**3**		☐	
(2)	50% or more of resilient flooring installed (by square feet) is certified to NSF 332 or equivalent.	**3**		☐	
(3)	50% or more of the insulation installed (by square feet) is certified to UL 2985 or equivalent.	**3**		☐	
(4)	50% or more of interior wall coverings installed (by square feet) is certified to NSF 342 or equivalent.	**3**		☐	
(5)	50% or more of the gypsum board installed (by square feet) is certified to UL 100 or equivalent.	**3**		☐	
(6)	50% or more of the door leafs installed (by number of door leafs) is certified to UL 102 or equivalent.	**3**		☐	
(7)	50% or more of the tile installed (by square feet) is certified to TCNA A138.1 Specifications for Sustainable Ceramic Tiles, Glass Tiles and Tile Installation Materials or equivalent.	**3**		☐	
612.3	**612.3 Universal design elements.** Dwelling incorporates one or more of the following universal design elements. Conventional industry construction tolerances are permitted.	**12 Max**	12		
(1)	Any no-step entrance into the dwelling which (1) is accessible from a substantially level parking or drop-off area (no more than 2%) via an accessible path which has no individual change in elevation or other obstruction of more than 1-1/2 inches in height with the pitch not exceeding 1 in 12 and (2) provides a minimum 32-inch wide clearance into the dwelling.	**3**		☑	verify
(2)	Minimum 36-inch wide accessible route from the no-step entrance into at least one visiting room in the dwelling and into at least one full or half bathroom which has a minimum 32-inch clear door width and a 30-inch by 48-inch clear area inside the bathroom outside the door swing.	**3**		☑	verify
(3)	Minimum 36-inch wide accessible route from the no-step entrance into at least one bedroom which has a minimum 32-inch clear door width.	**3**		☑	verify
(4)	Blocking or equivalent installed in the accessible bathroom walls for future installation of grab bars at water closet and bathing fixture, if applicable.	**1**		☑	verify
(5)	All interior and exterior door handles are levers rather than knobs.	**1**		☐	Unit doors all look to be lever, not sure about exterior doors. Some of those seem to be pull bars
(6)	All sink, lavatory and showering controls that comply with ICC A117.1.	**1**		☑	verify
(7)	Interior convenience Power receptacles, communication connections (for cable, phone, Ethernet, etc.) and switches are placed between 15" and 48" above the finished floor. Additional switches to control devices and systems (such as alarms, home theaters and other equipment) not required by the local building code may be installed as desired.	**1**		☑	verify
(8)	All light switches are rocker-type switches or other similar switches that can be operated by pressing them (with assistive devices). Toggle-type switches may not be used.	**1**		☐	
(9)	Any of the following can be controlled with a (wireless) mobile device such as a smartphone, tablet or laptop computer: HVAC, lighting, alarm system or door locks	**1 per system [5 max]**			

613 RESILIENT CONSTRUCTION

613.1	**613.1 Intent.** Design and construction practices developed by a licensed design professional or equivalent are implemented that enhance the resilience and durability of the structure (above building code minimum design loads) so the structure can better withstand forces generated by; flooding, snow, wind or seismic activity (as applicable) and reduce the potential for the loss of life and property.		2	base	
(a)	**Minimum structural requirements (base design).** The building is designed and constructed in compliance with structural requirements in the IBC or IRC as applicable.	**2**			
(b)	**Enhanced resilience – 10% above base design.** Design and construction practices are implemented that enhance the resilience and durability of the structure by designing and building to forces generated by; flooding, snow, wind or seismic (as applicable) that are 10% higher than the base design.	**3**			
(c)	**Enhanced resilience – 20% above base design.**	**5**			
(d)	**Enhanced resilience – 30% above base design.**	**10**			
(e)	**Enhanced resilience – 40% above base design.**	**12**			
(f)	**Enhanced resilience – 50% above base design.**	**15**			

END OF CHAPTER 6 CLICK TO PROCEED TO CHAPTER 7 >>

		Current Chapter level: Silver	**Total Points: 59**			
		Points away from: Bronze: 0, Silver: 0, Gold: 1, Emerald: N/A				
		Add'l pts earned above: Bronze: 29, Silver: 14, Gold: 0, Emerald: N/A				
		Total Chapter Points needed for: Bronze: 30, Silver: 45, Gold: 60, Emera				
		Revision Date: 3/28/2025				
Coding	Practice #	Chapter 7: Energy Efficiency	Points Available	Points Claimed	Status	Notes
		701 MINIMUM ENERGY EFFICIENCY REQUIREMENTS				
	701.1	**701.1 Mandatory requirements.** The building shall comply with Section 702 (Performance Path), Section 703 (Prescriptive Path), or Section 704 (ERI Target Path). Items listed as "mandatory" in Section 701.4 apply to all Paths. Unless otherwise noted, buildings in the Tropical Climate Zone shall comply with Climate Zone 1 requirements.			Select Path: Prescriptive Path	
		Please indicate energy modeler's professional credential and, in the notes field, their name. When selecting "Other," enter professional credentials (e.g., engineer, architect) within the notes field.			Modeler's Credential:	
	701.1.1	**701.1.1 Minimum Performance Path requirements.** A building complying with § 702 shall include a minimum of two practices from § 705, or a minimum of one practice from § 705 and a minimum of one practice from § 706.				
	701.1.2	**701.1.2 Minimum Prescriptive Path requirements.** A building complying with § 703 shall obtain a minimum of 30 points from § 703 and shall include a minimum of two practices from § 705, or a minimum of one practice from § 705 and a minimum of one practice from § 706.				
	701.1.3	**701.1.3 ERI Target Path requirements.** A building complying with § 704 shall obtain a minimum of 30 points from § 704 and shall include a minimum of two practices from § 705, or a minimum of one practice from § 705 and a minimum of one practice from § 706.				
	701.1.4	**701.1.4 Alternative bronze and silver level compliance**. As an alternative, any building that qualifies as an ENERGY STAR Version 3.0 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev. 03 building or demonstrates compliance with the 2018 IECC or Chapter 11 of the 2018 IRC achieves the bronze level for Chapter 7. As an alternative, any building that qualifies as an ENERGY STAR Version 3.1 Certified Home or ENERGY STAR Multifamily High Rise Version 1.0 Rev. 03 (with the baseline at ASHRAE 90.1-2010) building achieves the silver level for Chapter 7. As an alternative in the Tropical Climate Zone, any building that meets all of the requirements in IECC Section R401.2.1 (Tropical Zone) achieves the silver level for Chapter 7. The buildings achieving compliance under Section 701.1.4 are not eligible for achieving a rating level above silver.		0	Alternative: Option: Per interpretation, HI recognizes ES MFNC v1.1 for Alt Silver and ES MFNC v1.2 or ES v3.2 for Alt Gold.	
	701.1.6	**701.1.6 Alternative gold level compliance for tropical zones**. One- or two-family dwelling in the tropical zone at an elevation less than 2,400 feet (731.5 m) above sea level that complies with the following shall achieve the gold level for chapter 7:				
	(1)	The residence complies with IECC Tropical Zone than section R401.2.1.	N/A		☐	
	(2)	The residence includes a minimum of 2 kW of PV and a minimum of 6 kWh of battery storage.	N/A		☐	
	(3)	Any air conditioning has a minimum of 18 SEER.	N/A		☐	
	(4)	Solar, wind or other renewable energy source supplies not less than 90 percent of the energy for service water heating.	N/A		☐	
	(5)	Glazing in conditioned spaces has a solar heat gain coefficient of less than or equal to 0.25, or has an overhang with a projection factor equal to or greater than 0.30.	N/A		☐	
	(6)	The exterior roof/ceiling complies with at least two of the following:				
	(a)	Minimum roof reflectance and emittance in IECC Table C402.3	N/A		☐	
	(b)	Roof or ceiling has insulation with an R-value of R-15 or greater	N/A		☐	
	(c)	Includes a radiant barrier	N/A		☐	
	(7)	Walls comply with at least one of the following:				
	(a)	Walls have an overhang with a projection factor equal to or greater than 0.30	N/A		☐	
	(b)	Walls have insulation with an R-value of R-13 or greater	N/A		☐	
	(c)	Walls have a solar reflectance of 0.64	N/A		☐	
	(8)	A ceiling fan is provided for bedrooms and the largest space that is not used as a bedroom; alternately a whole house fan is provided.	N/A		☐	
	(9)	Wiring sufficient for a Level 2 (208/240V 40-80 amp) electric vehicle charging station is installed on the building site.	N/A		☐	
	701.2	**701.2 Emerald level points.** The Performance Path (Section 702) or the ERI Target Path (Section 704) shall be used to achieve the emerald level.	**Emerald Not Available**			
	701.3	**701.3 Adopting Entity review.** A review by the Adopting Entity or designated third party shall be conducted to verify design and compliance with Chapter 7.			☑	EDI
		NOTE: List the reviewer in the assigned Notes field.				
	701.4	**701.4 Mandatory practices.**				
	701.4.1	**701.4.1 HVAC systems.**				
	701.4.1.1	**701.4.1.1 HVAC system sizing.** Space heating and cooling system is sized according to heating and cooling loads calculated using ACCA Manual J, or equivalent. Equipment is selected using ACCA Manual S or equivalent.	**Mandatory**		☑	
	701.4.1.2	**701.4.1.2 Radiant and hydronic space heating.** Where installed as a primary heat source in the building, radiant or hydronic space heating system is designed, installed, and documented, using industry-approved guidelines and standards (e.g., ACCA Manual J, AHRI I=B=R, ACCA 5 QI-2010, or an accredited design professional's and manufacturer's recommendations).	**Mandatory**		No Radiant or Hydronic	
	701.4.2	**701.4.2 Duct systems.**				
	701.4.2.1	**701.4.2.1 Duct air sealing.** Ducts are air sealed. All duct sealing materials are in conformance with UL 181A or UL 181B specifications and are installed in accordance with manufacturer's instructions.	N/A		☐	
	701.4.2.2	**701.4.2.2 Ducts and Plenums.** Building framing cavities are not used as ducts or plenums.	N/A		☐	
	701.4.2.3	**701.4.2.3 Duct system sizing.** Duct system is sized and designed in accordance with ACCA Manual D or equivalent.	N/A		☐	

701.4.3		**701.4.3 Insulation and air sealing.**			
701.4.3.1		**701.4.3.1 Building Thermal Envelope Air Sealing.** The building thermal envelope is durably sealed to limit infiltration. The sealing methods between dissimilar materials allow for differential expansion and contraction. The following are caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material, suitable film, or solid material:		701.4.3.3 Exception: ☐	
	(a)	All joints, seams and penetrations.	Mandatory	Met	
	(b)	Site-built windows, doors, and skylights.		N/A	
	(c)	Openings between window and door assemblies and their respective jambs and framing.		Met	
	(d)	Utility penetrations.		Met	
	(e)	Dropped ceilings or chases adjacent to the thermal envelope.		Met	
	(f)	Knee walls.		N/A	
	(g)	Walls, ceilings, and floors separating conditioned spaces from unconditioned.		Met	
	(h)	Behind tubs and showers on exterior walls.		N/A	All showers / tubs against interior walls
	(i)	Common walls between dwelling units or sleeping units.		Met	
	(j)	Attic access openings.		Met	
	(k)	Joints of framing members at rim joists.		Met	
	(l)	Top and bottom plates.		Met	
	(m)	Other sources of infiltration.		N/A	
701.4.3.2		**701.4.3.2 Air barrier, air sealing, building envelope testing, and insulation.** Building envelope air barrier, air sealing envelope tightness, and insulation installation is verified to be in accordance with this Section and Section 701.4.3.2.1. Insulation installation other than Grade 1 is not permitted.	Mandatory		
	(1)	**Testing.** Building envelope tightness is tested. Testing is conducted in accordance with ASTM E-779 using a blower door at a test pressure of 1.04 psf (50 Pa). Testing is conducted after rough-in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances. Testing is conducted under the following conditions:		ACH50: 3.00 ELR:	EDI to test
	(a)	Exterior windows and doors, fireplace and stove doors are closed, but not sealed;			
	(b)	Dampers are closed, but not sealed, including exhaust, intake, makeup air, backdraft and flue dampers;			
	(c)	Interior doors are open;			
	(d)	Exterior openings for continuous ventilation systems and heat recovery ventilators are closed and sealed;			
	(e)	Heating and cooling systems are turned off;			
	(f)	HVAC duct terminations are not sealed; and			
	(g)	Supply and return registers are not sealed.			
		Multifamily Building Note: Testing by dwelling units, sleeping units, groups of dwelling units, groups of sleeping units, or the building as a whole is acceptable.			
	(2)	**Visual inspection.** The air barrier and insulation items listed in Table 701.4.3.2(2) are field verified by visual inspection. See Table 701.4.3.2(2)		☑	
701.4.3.2.1		**701.4.3.2.1 Grade I insulation installations.** Field-installed insulation products to ceilings, walls, floors, band joists, rim joists, conditioned attics, basements, and crawlspaces, except as specifically noted, are verified as Grade I by a third-party are in accordance with the following:	Mandatory	☑	
	(1)	Inspection is conducted before insulation is covered.			
	(2)	Air-permeable insulation is enclosed on all six sides and is in substantial contact with the sheathing material on one or more sides (interior or exterior) of the cavity. Air permeable insulation in ceilings is not required to be enclosed when the insulation is installed in substantial contact with the surfaces it is intended to insulate.			
	(3)	Cavity insulation uniformly fills each cavity side-to-side and top-to-bottom, without substantial gaps or voids around obstructions (such as blocking or bridging).			
	(4)	Cavity insulation compression or incomplete fill amounts to 2 percent or less, presuming the compressed or incomplete areas are a minimum of 70 percent of the intended fill thickness; occasional small gaps are acceptable.			
	(5)	Exterior rigid insulation has substantial contact with the structural framing members or sheathing materials and is tightly fitted at joints.			
	(6)	Cavity insulation is split, installed, and/or fitted tightly around wiring and other services.			
	(7)	Exterior sheathing is not visible from the interior through gaps in the cavity insulation.			
	(8)	Faced batt insulation is permitted to have side-stapled tabs, provided the tabs are stapled neatly with no buckling, and provided the batt is compressed only at the edges of each cavity, to the depth of the tab itself.			
	(9)	Where properly installed, ICFs, SIPs, and other wall systems that provide integral insulation are deemed in compliance with this section.			
701.4.3.3		**701.4.3.3 Multifamily air leakage alternative.** Multifamily buildings four or more stories in height and in compliance with IECC section C402.5 (Air leakage-thermal envelope) are deemed to comply with Sections 701.4.3.1 and 701.4.3.2.		See 701.4.3.1	
701.4.3.4		**701.4.3.4 Fenestration air leakage.** Windows, skylights and sliding glass doors have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m2), when tested in accordance with NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled. For site-built fenestration, a test report by an accredited, independent laboratory verifying compliance with the applicable infiltration rate shall be submitted to demonstrate compliance with this practice. This practice does not apply to field-fabricated fenestration products. **Exception:** For Tropical Zones Only, Jalousie windows are permitted to be used as a conditioned space boundary and shall have an air infiltration rate of not more than 1.3 cfm per square foot.	Mandatory	☑	
701.4.3.5		**701.4.3.5 Lighting in building thermal envelope.** Luminaires installed in the building thermal envelope which penetrate the air barrier are sealed to limit air leakage between conditioned and unconditioned spaces. All luminaires installed in the building thermal envelope which penetrate the air barrier are IC-rated and labeled as meeting ASTM E283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All luminaires installed in the building thermal envelope which penetrate the air barrier are sealed with a gasket or caulk between the housing and the interior of the wall or ceiling covering.	Mandatory	Met	There is recessed lighting, verify not through the envelope
701.4.4		**701.4.4 High-efficacy lighting.** Lighting efficacy in dwelling units or sleeping units is in accordance with one of the following:	Mandatory		
	(1)	A minimum of 75 percent of the total hard-wired lighting fixtures or the bulbs in those fixtures qualify as high efficacy or equivalent		☑	
	(2)	Lighting power density, measured in watts/square foot, is 1.1 or less.		☐	
701.4.5		**701.4.5 Boiler piping.** Boiler piping in unconditioned space supplying and returning heated water or steam is insulated.	N/A	☐	

702 PERFORMANCE PATH

702.1	**702.1 Point allocation.** Points from Section 702 (Performance Path) shall not be combined with points from Section 703 (Prescriptive Path) or Section 704 (ERI Target Path).				
702.2	**702.2 Energy performance levels.**				
702.2.1	**702.2.1 ICC IECC analysis.** Energy efficiency features are implemented to achieve energy cost or source energy performance that meets the ICC IECC. A documented analysis using software in accordance with ICC IECC, Section R405, or ICC IECC Section C407.2 through C407.5, applied as defined in the ICC IECC, is required.	N/A		☐	
702.2.2	**702.2.2 Energy performance analysis.** Energy savings levels above the ICC IECC are determined through an analysis that includes improvements in building envelope, air infiltration, heating system efficiencies, cooling system efficiencies, duct sealing, water heating system efficiencies, lighting, appliances, and on-site renewable energy. Points are assigned using the following formula: **Points = 30 + (percent above NGBS Reference Home) * 2** Multifamily Building Note: Modeling is completed building-wide using one of the following methods: whole building energy modeling, a unit-by-unit approach, or a building average of a unit-by-unit approach.	**Points per formula**	0	Percent above NGBS Reference Home:	
702.2.3	**702.2.3 Tropical standard reference design.** For the Tropical Climate Zone, the standard reference design shall use the specifications in IECC Section R401.2.1 (Tropical Zone).				

703 PRESCRIPTIVE PATH

703.1	**703.1 Mandatory practices.**	**30**	**30**		
703.1.1	**703.1.1 Building thermal envelope compliance.** The building thermal envelope is in compliance with Section 703.1.1.1 or 703.1.1.2. Exception: Section 703.1.1 is not required for Tropical Climate Zone.	**Mandatory**		☑	
703.1.1.1	**703.1.1.1 Maximum UA and SHGC.** For IECC residential buildings, the total building UA is less than or equal to the total maximum UA as computed by ICC IECC Section R402.1.5. The SHGC requirements for fenestration in Table R402.1.2 are also met. For IECC commercial buildings, the total UA is less than or equal to the sum of the UA for ICC IECC Tables C402.1.4 and C402.4, including the U-factor times the area and C-factor or F-factor times the perimeter. The SHGC requirements for fenestration in Table C402.4 are also met. The total UA proposed and baseline calculations are documented. REScheck or COMcheck is deemed to provide UA calculation documentation.				
703.1.1.2	**703.1.1.2 Prescriptive R-values and fenestration requirements**. The building thermal envelope is in accordance with the insulation and fenestration requirements of ICC IECC Table R402.1.2 or Tables C402.1.3. The fenestration U-factors and SHGC's are in accordance with Table 703.2.5.1 or ICC IECC Table C402.4.				
703.1.2	**703.1.2 Building envelope leakage.** The building thermal envelope is in accordance with ICC IECC R402.4.1.2 or C402.5 as applicable. Exception: Section 703.1.2 is not required for Tropical Climate Zone	**Mandatory**		☑	
703.1.3	**703.1.3 Duct Testing.** The duct system is in accordance with ICC IECC R403.3.2 through R403.3.5 as applicable.	**N/A**		Met; Not Tested Rough-In Test: Postconstruction Test:	
703.2	**703.2 Building envelope**				
703.2.1	**703.2.1 UA improvement.** The total building thermal envelope UA is less than or equal to the baseline total UA resulting from the U-factors provided in Table 703.2.1(a) or ICC IECC Tables C402.1.4 and C402.4, as applicable. Where insulation is used to achieve the UA improvement, the insulation installation is in accordance with Grade 1 meeting Section 701.4.3.2.1 as verified by a third-party. Total UA is documented using a RESCheck, COMCheck, or equivalent report to verify the baseline and the UA improvement. See Table 703.2.1(a)	Per Table 703.2.1(b)	0	☐ UA Improvement:	
703.2.2	**703.2.2 Mass walls.** More than 75 percent of the above-grade exterior opaque wall area of the building is mass walls.	Per Table 703.2.2	0	Mass thickness:	
703.2.3	**703.2.3** A radiant barrier with an emittance of 0.05 or less is used in the attic. The product is tested in accordance with ASTM C1371 and installed in accordance with the manufacturer's instructions.	**1**	0	☐	
703.2.4	**703.2.4 Building envelope leakage**. The maximum building envelope leakage rate is in accordance with Table 703.2.4a or Table 703.2.4b and whole building ventilation is provided in accordance with Section 902.2.1.	Per Table 703.2.4a or 703.2.4b	0	Air leakage from 701.4.3.2 or 705.6.2.1: 3.00	
703.2.5	**703.2.5 Fenestration**				
703.2.5.1	**703.2.5.1** NFRC-certified (or equivalent) U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) on an area-weighted average basis do not exceed the values in Table 703.2.5.1. Area weighted averages are calculated separately for the categories of 1) windows and exterior doors and 2) skylights and tubular daylighting devices (TDDs). Decorative fenestration elements with a combined total maximum area of 15 square feet (1.39 m2) or 10 percent of the total glazing area, whichever is less, are not required to comply with this practice. See Table 703.2.5.1	**Mandatory**		Met	
703.2.5.1.1	**703.2.5.1.1 Dynamic glazing.** Dynamic glazing is permitted to satisfy the SHGC requirements of Table 703.2.5.1 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 2.4 and the dynamic glazing is automatically controlled to modulate the amount of solar gain into the space in multiple steps. Fenestration with dynamic glazing is considered separately from other fenestration and area-weighted averaging with fenestration that does not use dynamic glazing is not permitted. Dynamic glazing is not required to be automatically controlled or comply with minimum SHGC ratio when both the lower and higher labeled SHGC already comply with the requirements of Table 703.2.5.1.			N/A	no dynamic glazing
703.2.5.2	**703.2.5.2** The NFRC-certified (or equivalent) U-factor and SHGC of windows, exterior doors, skylights, and tubular daylighting devices (TDDs) are in accordance with Table 703.2.5.2(a), (b), or (c). Decorative fenestration elements with a combined total maximum area of 15 square feet (1.39 m^2) or 10 percent of the total glazing area, whichever is less, are not required to comply with this practice.	Per Table 703.2.5.2(a) or 703.2.5.2(b) or 703.2.5.2(c)	0		
	(a) Table 703.2.5.2(a)	**3**			
	(b) Table 703.2.5.2(b)	**4**			
	(c) Table 703.2.5.2(c)	**18**			
703.2.5.2.1	**703.2.5.2.1 Dynamic glazing.** Dynamic glazing is permitted to satisfy the SHGC requirements of Tables 703.2.5.2(a), 703.2.5.2(b), and 703.2.5.2(c) provided the ratio of the higher to lower labeled SHGC is greater than or equal to 2.4, and the dynamic glazing is automatically controlled to modulate the amount of solar gain into the space in multiple steps. Fenestration with dynamic glazing is considered separately from other fenestration, and area-weighted averaging with fenestration that does not use dynamic glazing is not permitted. Dynamic glazing is not required to be automatically controlled or comply with minimum SHGC ratio when both the lower and higher labeled SHGC already comply with the requirements of Tables 703.2.5.2(a), 703.2.5.2(b), and 703.2.5.2(c).				

703.3		**HVAC equipment efficiency**				
703.3.0		**703.3.0 Multiple heating and cooling systems.** For multiple heating or cooling systems in one home, practices 703.3.1 through 703.3.6 apply to the system that supplies 80% or more of the total installed heating or cooling capacity. Where multiple systems each serve less than 80% of the total installed heating or cooling capacity, points under Sections 703.3.1 through 703.3.6 are awarded either for the system eligible for the fewest points or the weighted average of the systems. The weighted average shall be calculated in accordance with the following equation and be based upon the efficiency and capacity of the equipment as selected in accordance with ACCA Manual S with it loads calculated in accordance with ACCA Manual J. Weighted Average = $[(E_{unit\,1}*C_{unit\,1})+(E_{unit\,2}*C_{unit\,2})+\ldots+(E_{unit\,n}*C_{unit\,n})] / (C_{unit\,1}+C_{unit\,2}+\ldots+C_{unit\,n})$ where: E = Rated AHRI efficiency for unit C = Rated heating or cooling capacity for unit *n* = Unit count			multiple heating sys.? No multiple cooling sys.? No	
703.3.1		**703.3.1** Combination space heating and water heating system (combo system) is installed using either a coil from the water heater connected to an air handler to provide heat for the building, dwelling unit or sleeping unit, or a space heating boiler using an indirect-fired water heater. Devices have a minimum combined annual efficiency of 0.80 and a minimum water heating recovery efficiency of 0.87.	**4**	0	☐	
703.3.2		**703.3.2** Furnace and/or boiler efficiency is in accordance with one of the following:				
	(1)	Gas and propane heaters:		0	Min. or Average AFUE:	
		≥90% AFUE	**8**			
		≥92% AFUE	**10**			
		≥94% AFUE	**11**			
		≥96% AFUE	**12**			
		≥98% AFUE	**13**			
	(2)	Oil furnace:		0	Min. or Average AFUE:	
		≥85% AFUE	**3**			
		≥90% AFUE	**6**			
	(3)	Gas boiler:		0	Min. or Average AFUE:	
		≥85% AFUE	**3**			
		≥90% AFUE	**6**			
		≥94% AFUE	**8**			
		≥96% AFUE	**9**			
	(4)	Oil boiler:		0	Min. or Average AFUE:	
		≥85% AFUE	**3**			
		≥90% AFUE	**6**			
703.3.3		**703.3.3** Heat pump heating efficiency is in accordance with Table 703.3.3(1) or Table 703.3.3(2) or Table 703.3.3(3). Refrigerant charge is verified for compliance with manufacturer's instructions utilizing a method in Section 4.3 of ACCA 5 QI-2010.				
	(1)	Electric Heat Pump Heating		11	Min. or Average HSPF:	
		≥8.5 HSPF	**11**		10.0	
		≥9.0 HSPF	**11**			
		≥9.5 HSPF	**11**			
		≥10.0 HSPF	**11**			
		≥12.0 HSPF	**11**			
	(2)	Electric Heat Pump Heating for Multifamily Buildings Four or More Stories in Height	**11**	0	Min. or Average HSPF:	
	(3)	Gas Engine-Driven Heat Pump Heating (≥1.3 COP at 47°F)	**16**	0	Min. or Average COP:	
703.3.4		**703.3.4** Cooling efficiency is in accordance with Table 703.3.4(1) or Table 703.3.4(2). Refrigerant charge is verified for compliance with manufacturer's instructions utilizing a method in Section 4.3 of ACCA 5 QI-2010.				
	(1)	Electric Air Conditioner and Heat Pump Cooling		3	Min. or Average SEER:	
		≥15 SEER	**1**		18.0	
		≥17 SEER	**3**			
		≥19 SEER	**4**			
		≥21 SEER	**6**			
		≥25 SEER	**8**			
	(*)	Tropical Climate Zone: None of the occupied space is air conditioned and ceiling fans are provided for bedrooms and the largest space which is not used as a bedroom.	**20**	0	☐	
	(2)	Gas Engine-Driven Heat Pump Cooling (≥1.2 COP at 95°F)	**1**	0	Min. or Average COP:	
703.3.5		**703.3.5** Water source cooling and heating efficiency is in accordance with Table 703.3.5. Refrigerant charge is verified for compliance with manufacturer's instructions utilizing a method in Section 4.3 of ACCA 5 QI-2010.	**37**	0	☐	
		≥15 SEER, ≥4.0 COP				
703.3.6		**703.3.6** Ground source heat pump is installed by a Certified Geothermal Service Contractor in accordance with Table 703.3.6. Refrigerant charge is verified for compliance with manufacturer's instructions utilizing a method in Section 4.3 of ACCA 5 QI-2010.		0	Min. or Average EER:	
		≥16 EER, ≥3.6 COP	**22**			
		≥24 EER, ≥4.3 COP	**35**			
		≥28 EER, ≥4.8 COP	**44**			
703.3.7		**703.3.7** ENERGY STAR, or equivalent, ceiling fans are installed. **(Points awarded per building.)** **Note for Tropical Climate Zone and Climate Zones 2B, 3B, and 4B: points awarded per fan where AC is not installed in the dwelling unit or sleeping unit (Max 8 points), and where points awarded in Section 703.3.8 for these specific climate zones, points shall not be awarded in Section 703.3.7** NOTE: For multi-unit buildings, each dwelling unit must comply to claim this point.	**1**	0	☐ # of fans:	
703.3.8		**703.3.8** Whole-building or whole-dwelling unit or whole-sleeping unit fan(s) with insulated louvers and a sealed enclosure is installed. **(Points awarded per building.)** NOTE: For multi-unit buildings, each dwelling unit must have compliant whole-dwelling unit fans installed to claim these points.	**3**	0	☐	
703.4		**703.4 Duct Systems**				
703.4.1		**703.4.1** All space heating is provided by a system(s) that does not include air ducts. (No points awarded for multifamily buildings four or more stories in height.)	**8**	0	☐	
703.4.2		**703.4.2** All space cooling is provided by a system(s) that does not include air ducts. (No points awarded for multifamily buildings four or more stories in height.)	**1**	0	☐	
703.4.3		**703.4.3** Ductwork is in accordance with all of the following:	**8**	0		
	(1)	Building cavities are not used as return ductwork.			☐	
	(2)	Heating and cooling ducts and mechanical equipment are installed within the conditioned building space.			☐	
	(3)	Ductwork is not installed in exterior walls. (No points awarded for multifamily buildings four or more stories in height.)			☐	
703.4.4		**703.4.4 Duct Leakage.** The entire central HVAC duct system, including air handlers and register boots, is tested by a third party for total leakage at a pressure differential of 0.1 inches w.g. (25 Pa) and maximum air leakage is equal to or less than 6 percent of the system design flow rate or 4 cubic feet per minute per 100 square feet of conditioned floor area. **(Points not awarded if points are taken under Section 705.6.2.3)**		0		
	(1)	ductwork entirely outside the building's thermal envelope	**2**			
	(2)	ductwork entirely inside the building's thermal envelope	**1**			
	(3)	ductwork inside and outside the building's thermal envelope	**1**			

703.5		**703.5 Water heating system**					
703.5.1		**703.5.1** Water heater Uniform Energy Factor (UEF) is in accordance with the following:				type:	
		Where multiple systems are used, points awarded based on the system with the lowest efficiency.				Gas	
		Water heater design is based on only 1 (one) water heater per dwelling unit, based on approved methods from IPC or ASPE or manufacturer specifications.					
		All table values are based on water heaters with medium water draws as defined by the US DOE text procedures (55 gallons per day).					
						type:	
	(1)	Gas water heating				(c)	
	(a)	Storage Water Heater, Rated Storage Volume > 20 Gallons and ≤ 55 Gallons, Medium Water Draw			0	efficiency:	
						0.94	
		UEF: 0.65 to <0.78	**2**				
		UEF: ≥0.78	**3**				
	(b)	Storage Water Heater, Rated Storage Volume > 55 Gallons and ≤ 100 Gallons, Medium Water Draw	**1**	0			
	(c)	Storage Water Heater with Input Rate Greater than 75,000 Btu/h (Commercial)			3		
		Thermal Efficiency: 0.90 to < 0.95	**3**				
		Thermal Efficiency: ≥0.95	**4**				
	(d)	Storage Water Heater with Input Rate Greater than 75,000 Btu/H (Commercial), In Buildings with High-Capacity Service Water-Heating Systems (1,000,000 Btu/h or Greater)			0		
		Thermal Efficiency: 0.92 to < 0.95	**1**				
		Thermal Efficiency: ≥0.95	**2**				
	(e)	Instantaneous Water Heater, Rated Storage Volume < 2 Gallons and Input Rate of > 50,000 Btu/h, Medium Water Draw			0		
		UEF: 0.89 to < 0.94	**1**				
		UEF: ≥0.94	**2**			type:	
	(2)	Electric water heating					
	(a)	Storage Water Heater, Rated Storage Volume ≥ 20 Gallons and ≤ 55 Gallons, Medium Water Draw			0	efficiency:	
		UEF: 0.94 to <1.0	**1**				
		UEF: 1.0 to <1.5	**1**				
		UEF: 1.5 to <2.0	**2**				
		UEF: 2.0 to <2.2	**4**				
		UEF: 2.2 to <2.5	**5**				
		UEF: 2.5 to <3.0	**6**				
		UEF: ≥3.0	**8**				
	(b)	Storage Water Heater, Rated Storage Volume ≥ 55 Gallons and ≤ 120 Gallons, Medium Water Draw			0		
		UEF: 2.2 to <2.5	**2**				
		UEF: 2.5 to <3.0	**3**				
		UEF: 3.0 to <3.5	**3**				
		UEF: ≥3.5	**4**				
	(c)	Electric Tabletop Water Heating (Tabletop Water Heater, Rated Storage Volume ≥ 20 Gallons and ≤ 120 Gallons, Medium Water Draw)	**1**	0			
	(d)	Electric Instantaneous Water Heating (Instantaneous Electric Water Heater, Rated Storage Volume < 2 Gallons, Medium Water Draw)	**1**	0			
	(e)	Electric Grid Enabled Water Heating (Grid Enabled Storage Water Heater, Rated Storage Volume ≥ 75 Gallons, Medium Water Draw)	**2**	0		efficiency:	
	(3)	Oil water heating (Oil water heating, < 50 gallons, Medium water draw)	**1**	0			
703.5.2		**703.5.2** Desuperheater is installed by a qualified installer or is pre-installed in the factory.	**5**	0		☐	
703.5.3		**703.5.3** Drain-water heat recovery system is installed. **(Points awarded per building.)**	**2**	0		☐	
703.5.4		**703.5.4** Indirect-fired water heater storage tanks heated from boiler systems are installed.	**1**	0		☐	
703.5.5		**703.5.5 Solar water heater.** SRCC (Solar Rating & Certification Corporation) OG 300 rated, or equivalent, solar domestic water heating system is installed. Solar Energy Factor (SEF) as defined by SRCC is in accordance with Table 703.5.5(a) and Table 703.5.5(b).				type:	
	(a)	Storage Water Heater, Rated Storage Volume of Backup Water Heater is ≥ 0.1 Gallon and ≤ 55 Gallons, Medium Water Draw			0	SEF:	
		SEF ≥ 1.3	**6**				
		SEF ≥ 1.51	**9**				
		SEF ≥ 1.81	**13**				
		SEF ≥ 2.31	**19**				
		SEF ≥ 3.01	**30**				
	(b)	Storage Water Heater, Rated Storage Volume of Backup Water Heater is >55 Gallons, Medium Water Draw			0		
		SEF ≥ 1.3	**7**				
		SEF ≥ 1.51	**10**				
		SEF ≥ 1.81	**14**				
		SEF ≥ 2.31	**21**				
		SEF ≥ 3.01	**30**				
703.6		**703.6 Lighting and appliances**					
703.6.1		**703.6.1 Hard-wired lighting.** Hard-wired lighting is in accordance with one of the following:					
	(1)	A minimum percent (95%) of the total hard-wired interior luminaires or lamps qualify as ENERGY STAR, DesignLights Consortium (DLC), or applicable equivalent.	**2**	0		☐	
	(2)	A minimum of 80 percent of the exterior lighting wattage has a minimum efficacy of 61 lumens per watt or is solar-powered.	**1**	0		☐	
	(3)	In multifamily buildings, common area lighting power density (LPD) is less than 0.51 Watts per square foot.	**7**	0		☐	
703.6.2		**703.6.2 Appliances.** ENERGY STAR or equivalent appliance(s) are installed:					
	(1)	Refrigerator	**1**	1		☑	in scope; verify
	(2)	Dishwasher	**1**	1		☑	in scope; verify
	(3)	Washing machine	**4**	0		☐	
		Multifamily Building Note: Washing machines in ALL units must comply.					

703.7		**703.7 Passive solar design**				
703.7.1		**703.7.1 Sun-tempered design.** Building orientation, sizing of glazing, and design of overhangs are in accordance with all of the following:	**4**	0	☐	
	(1)	The long side (or one side if of equal length) of the building faces within 20 degrees of true south.				
	(2)	Vertical glazing area is between 5 and 7 percent of the gross conditioned floor area on the south face [also see Section 703.7.1(8)] and glazing U-factors meet Table 703.2.5.2(a).				
	(3)	Vertical glazing area is less than 2 percent of the gross conditioned floor area on the west face, and glazing meets Table 703.2.5.2(a).				
	(4)	Vertical glazing area is less than 4 percent of the gross conditioned floor area on the east face, and glazing meets Table 703.2.5.2(a).				
	(5)	Vertical glazing area is less than 8 percent of the gross conditioned floor area on the north face, and glazing meets Table 703.2.5.2(a).				
	(6)	Skylights, where installed, are in accordance with the following:				
	(a)	shades and insulated wells are used, and all glazing meets Table 703.2.5.2(a)				
	(b)	horizontal skylights are less than 0.5 percent of finished ceiling area				
	(c)	sloped skylights on slopes facing within 45 degrees of true south, east, or west are less than 1.5 percent of the finished ceiling area				
	(7)	Overhangs or adjustable canopies or awnings or trellises provide shading on south-facing glass for the appropriate climate zone in accordance with Table 703.7.1(7): See Table 703.7.1(7)				
	(8)	The south face windows have a SHGC of 0.40 or higher.				
	(9)	Return air or transfer grilles/ducts are in accordance with Section 705.4.				
		Multifamily Building Note: The site is designed such that at least 40 percent of the multifamily dwelling or sleeping units have one south facing wall (within 15 degrees) containing at least 50 percent of glazing for entire unit, Effective shading is required for passive solar control on all south facing glazing. The floor area of at least 15 feet from the south facing perimeter glazing is massive and exposed to capture solar heat during the day and reradiate at night.				
703.7.2		**703.7.2 Window shading.** Automated solar protection or dynamic glazing is installed to provide shading for windows.	**1**	0	☐	
703.7.3		**703.7.3 Passive cooling design.** Passive cooling design features are in accordance with three or more of the following:		0		
		Points for three items:	**3**			
		Points for one additional item:	**1**			
	(1)	Exterior shading is provided on east and west windows using one or a combination of the following:				
	(a)	vine-covered trellises with the vegetation separated a minimum of 1 foot (305 mm) from face of building			☐	
	(b)	moveable awnings or louvers			☐	
	(c)	covered porches			☐	
	(d)	attached or detached conditioned/unconditioned enclosed space that provides full shade of east and west windows (e.g., detached garage, shed, or building)			☐	
	(2)	Overhangs are installed to provide shading on south-facing glazing in accordance with Section 703.7.1(7). **(Points not awarded if points are taken under Section 703.7.1.)**			☐	
	(3)	Windows and/or venting skylights are located to facilitate cross and stack effect ventilation.			☐	
	(4)	Solar reflective roof or radiant barrier is installed in climate zones 1, 2, or 3 and roof material achieves a 3-year aged criteria of 0.50.			☐	
	(5)	Internal exposed thermal mass is a minimum of three inches (76 mm) in thickness. Thermal mass consists of concrete, brick, and/or tile fully adhered to a masonry base or other masonry material in accordance with one or a combination of the following:				
	(a)	A minimum of 1 square foot (0.09 m^2) of exposed thermal mass of floor per 3 square feet (2.8 m^2) of gross finished floor area.			☐	
	(b)	A minimum of 3 square feet (2.8 m^2) of exposed thermal mass in interior walls or elements per square foot (0.09 m^2) of gross finished floor area.			☐	
	(6)	Roofing material is installed with a minimum 0.75 inch (19 mm) continuous air space offset from the roof deck from eave to ridge.			☐	
703.7.4		**703.7.4 Passive solar heating design**. In addition to the sun-tempered design features in Section 703.7.1, all of the following are implemented: Note: Points shall not be awarded in the Tropical Climate Zone.	**4**	0	☐	
	(1)	Additional glazing, no greater than 12 percent, is permitted on the south wall. This additional glazing is in accordance with the requirements of Section 703.7.1.				
	(2)	Additional thermal mass for any room with south-facing glazing of more than 7 percent of the finished floor area is provided in accordance with the following:				
	(a)	Thermal mass is solid and a minimum of 3 inches (76 mm) in thickness. Where two thermal mass materials are layered together (e.g., ceramic tile on concrete base) to achieve the appropriate thickness, they are fully adhered to (touching) each other.				
	(b)	Thermal mass directly exposed to sunlight is provided in accordance with the following minimum ratios:				
	(i)	Above latitude 35 degrees: 5 square feet (0.465 m^2) of thermal mass for every 1 square foot (0.0929 m^2) of south-facing glazing.				
	(ii)	Latitude 30 degrees to 35 degrees: 5.5 square feet (0.51 m^2) of thermal mass for every 1 square foot (0.0929 m^2) of south-facing glazing.				
	(iii)	Latitude 25 degrees to 30 degrees: 6 square feet (0.557 m^2) of thermal mass for every 1 square foot (0.0929 m^2) of south-facing glazing.				
	(c)	Thermal mass not directly exposed to sunlight is permitted to be used to achieve thermal mass requirements of Section 703.7.4 (2) based on a ratio of 40 square feet (3.72 m^2) of thermal mass for every 1 square foot (0.0929 m^2) of south-facing glazing.				
	(3)	In addition to return air or transfer grilles/ducts required by Section 703.7.1(9), provisions for forced airflow to adjoining areas are implemented as needed.				
704 ERI TARGET PATH						
704.1		**704.1 ERI target compliance.** Compliance with the energy chapter shall be permitted to be based on the EPA National ERI Target Procedure for Energy Star Certified Homes. Points from Section 704 (ERI Target) shall not be combined with points from Section 702 (Performance Path) or Section 703 (Prescriptive Path). Dwelling ratings shall be submitted to a Rating Certification Body approved by the Adopting Entity for calculating points under this section.		0	EPA National ERI Target:	
704.2		**704.2 Point calculation.** Points for Section 704 shall be computed based on Step "1" of the EPA National ERI Target Procedure. Points shall be computed individually for each building as follows: **30 + (Number of National ERI Points less than EnergyStar National ERI Target for that building) * 2.**			ERI As Designed:	

705 ADDITIONAL PRACTICES

705.2		**705.2 Lighting**				
705.2.1		**705.2.1 Lighting controls** (Percentages for point thresholds are based on lighting not required for means of egress or security lighting as defined by local building codes.)				
705.2.1.1		**705.2.1.1 Interior lighting.** In dwelling units or sleeping units, permanently installed interior lighting fixtures are controlled with an occupancy sensor, or dimmer:		0		
	(1)	50 percent to less than 75 percent of lighting fixtures.	**1**			
	(2)	A minimum of 75 percent of lighting fixtures.	**2**			
705.2.1.2		**705.2.1.2 Exterior lighting.** Photo or motion sensors are installed on 75 percent of outdoor lighting fixtures to control lighting.	**1**	0	☐	
705.2.1.3		**705.2.1.3 Multifamily common areas.**				
	(1)	In a multifamily building, occupancy sensors, or dimmers are installed in common areas (except corridors and stairwells).		0		
	(a)	50 percent to less than 75 percent of lighting fixtures.	**1**			
	(b)	A minimum of 75 percent of lighting fixtures.	**2**			
	(2)	In a multifamily building, occupancy controls are installed to automatically reduce light levels in interior corridors and exit stairwells when the space is unoccupied. Light levels are reduced by:		2	(a)	in plans, verify
	(a)	50 percent to less than 75 percent or to local minimum requirements	**2**			
	(b)	A minimum of 75 percent	**3**			
705.2.1.4		**705.2.1.4** In a multifamily building, occupancy controls are installed to automatically reduce light levels in garages and parking structures when the space is unoccupied. Light levels are reduced by:		0		
	(1)	50 percent to less than 75 percent or to local minimum requirements	**2**			
	(2)	A minimum of 75 percent	**3**			
705.2.2		**705.2.2 TDDs and skylights.** A tubular daylighting device (TDD) or a skylight that meets the requirements of Table 703.2.5.2(a) is installed in rooms without windows. (Points awarded per building.)	**2**	0	☐	
705.2.3		**705.2.3 Lighting outlets.** Occupancy sensors are installed for a minimum of 80 percent of hard-wired lighting outlets in the interior living space.	**1**	0	☐	
705.2.4		**705.2.4 Recessed luminaires.** The number of recessed luminaires that penetrates the thermal envelope is less than 1 per 400 square feet (37.16 m^2) of total conditioned floor area and they are in accordance with Section **701.4.3.5**.	**1**	0	# of luminaires: per 51188 square feet	confirm whether or not recessed lighting penetrates emvelope
705.3		**705.3 Induction cooktop.** Induction cooktop is installed.	**1**	0	☐	
705.4		**705.4 Return ducts and transfer grilles.** Return ducts or transfer grilles are installed in every room with a door. Return ducts or transfer grilles are not required for bathrooms, kitchens, closets, pantries, and laundry rooms.	**2**	0	☐	
705.5		**705.5 HVAC design and installation**				
705.5.1		**705.5.1** Meet one or both of the following:				
	(1)	HVAC contractor is certified by the Air Conditioning Contractors of Americas Quality Assured Program (ACCA/QA) or by an EPA-recognized HVAC Quality Installation Training Oversight Organization (H-QUITO) or equivalent.	**1**	0	☐	
	(2)	HVAC installation technician(s) is certified by North American Technician Excellence, Inc. (NATE) or equivalent.	**1**	0	☐	
705.5.2		**705.5.2** Performance of the heating and/or cooling system is verified by the HVAC contractor in accordance with all of the following:	**3**	0	☐	
	(1)	Start-up procedure is performed in accordance with the manufacturer's instructions.				
	(2)	Refrigerant charge is verified by super-heat and/or sub-cooling method.				
	(3)	Burner is set to fire at input level listed on nameplate.				
	(4)	Air handler setting/fan speed is set in accordance with manufacturer's instructions.				
	(5)	Total airflow is within 10 percent of design flow.				
	(6)	Total external system static does not exceed equipment capability at rated airflow.				
705.5.3		**705.5.3** HVAC Design is verified by 3rd party as follows:				
	(1)	The ENERGY STAR HVAC Design and Rater Design Review Checklists are completed and correct.	**3**	0	☐	
	(2)	HVAC Installation is inspected and conforms to HVAC design documents and plans.	**3**	3	☑	
705.6		**705.6 Installation and performance verification.**				
705.6.1		**705.6.1** Third-party on-site inspection is conducted to verify compliance with all of the following, as applicable. Minimum of two inspections are performed: one inspection after insulation is installed and prior to covering, and another inspection upon completion of the building. Where multiple buildings or dwelling units of the same model or sleeping units of the same model are built by the same builder, a representative sample inspection of a minimum of 15 percent of the buildings or dwelling units or sleeping units is permitted.	**3**	3	By using this tool, this project automatically qualifies for this practice.	

705.6.2		**705.6.2 Testing.** Testing is conducted to verify performance:				
705.6.2.1		**705.6.2.1 Air leakage validation of building or dwelling units or sleeping units.** A visual inspection is performed as described in 701.4.3.2(2) and air leakage testing is performed in accordance with ASTM E779 or ASTM E1827.				
		(Points awarded only for buildings where building envelope leakage testing is not required by ICC IECC.)				
		(Points not awarded if points are taken under Section 703.2.4)			ACH50:	
	(1)	A blower door test.	3	0	ELR:	
	(2)	Third-party verification is completed.	5	0	☐	
		NOTE: Specify name of person or company conducting blower door test in the assigned Notes area.				
705.6.2.2		**705.6.2.2 HVAC airflow testing.** Balanced HVAC airflows are demonstrated by flow hood or other acceptable flow measurement tool by a third party. Test results are in accordance with the following:				
	(1)	Measured flow at each supply and return register meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2.	5	0	☐	
	(2)	Total airflow meets or exceeds the requirements in ACCA 5 QI-2010, Section 5.2.	3	0	☐	
		NOTE: Specify name of person or company conducting HVAC airflow test in the assigned Notes area.				
705.6.2.3		**705.6.2.3 HVAC duct leakage testing.** One of the following is achieved:				
		(Points awarded only where these practices are not required by IECC.)		0		
		(Points not awarded if points are taken under Section 703.4.4)				
	(1)	Duct leakage is in accordance with IECC R403.3.3 and R403.3.4.	3			
	(2)	Duct leakage is in accordance with IECC R403.3.3 and R403.3.4, and testing is conducted by an independent third party.	5			
705.6.3		**705.6.3 Insulating hot water pipes.** Insulation with a minimum thermal resistance (R-value) of at least R-3 is applied to the following, as applicable:	1	0	☑	
		(Points awarded only where these practices are not required by IECC.)			☑ required by IECC:	
	(a)	piping 3/4-inch and larger in outside diameter				
	(b)	piping serving more than one dwelling unit or sleeping unit				
	(c)	piping located outside the conditioned space				
	(d)	piping from the water heater to a distribution manifold				
	(e)	piping located under a floor slab				
	(f)	buried piping				
	(g)	supply and return piping in recirculation systems other than demand recirculation systems				
705.6.4		**705.6.4 Potable hot water demand re-circulation system.**				
705.6.4.1		**705.6.4.1** Potable hot water demand re-circulation system is installed in a single-family unit.	1	0	☐	
705.6.4.2		**705.6.4.2** Potable hot water demand re-circulation system(s) that serves every unit in a multifamily building is installed in place of a standard circulation pump and control.	2	0	☐	
705.7		**705.7** In multi-unit buildings, an advanced electric and fossil fuel submetering system is installed to monitor electricity and fossil fuel consumption for each unit. The device provides consumption information on a monthly or near real-time basis. The information is available to the occupants at a minimum on a monthly basis.	1	0	☐	

706 INNOVATIVE PRACTICES

706.1		**706.1 Energy consumption control.** A whole-building or whole-dwelling unit or whole-sleeping unit device or system is installed that controls or monitors energy consumption.	3 Max	0		
	(1)	programmable communicating thermostat with the capability to be controlled remotely	1		☐	
	(2)	energy-monitoring device or system	1		☐	
	(3)	energy management control system	3		☐	
	(4)	programmable thermostat with control capability based on occupant presence or usage pattern	1		☐	
	(5)	lighting control system	1		☐	
706.2		**706.2 Renewable energy service plan.** Renewable energy service plan is provided as follows:				
	(1)	Builder selects a renewable energy service plan provided by the local electrical utility for interim (temporary) electric service, or purchases renewable energy certificates (RECs) to cover electricity used. The builder's local administrative office has renewable energy service or has otherwise been paired with RECs. Green-ecertified (or equivalent) is required for renewable electricity purchases.	1	0	☐	
	(2)	The buyer of the building selects one of the following renewable energy service plans provided by the utility prior to occupancy of the building with a minimum two-year commitment.		0		
	(a)	less than half of the dwelling's projected electricity and gas use is provided by renewable energy	1			
	(b)	half or more of the of the dwelling's projected electricity and gas use is provided by renewable energy	2			
706.3		**706.3 Smart Appliances and Systems.** Smart appliances and systems are installed as follows:		0		
		Three to five smart appliances installed	1			
		Six or more smart appliances installed	2			
		(Items (7) and (8) are permitted to count as two appliances each for the purpose of awarding points.)				
		(where points awarded in Section 706.3, points shall not be awarded in Section 706.7 and 706.9)				
	(1)	Refrigerator			☐	
	(2)	Freezer			☐	
	(3)	Dishwasher			☐	
	(4)	Clothes Dryer			☐	
	(5)	Clothes Washer			☐	
	(6)	Room Air Conditioner			☐	
	(7)	HVAC Systems			☐	
	(8)	Service Hot Water Heating Systems			☐	
706.4		**706.4 Pumps.**				
706.4.1		**706.4.1** Pool, spa, and water features equipped with filtration pumps as follows:				
	(1)	Electronically controlled variable-speed pump(s) is installed (full load efficiency of 90 percent or greater).	1	0	☐	
	(2)	Electronically controlled variable-speed pump(s) is installed (full load efficiency of 90 percent or greater) in a pool	3	0	☐	
706.4.2		**706.4.2** Sump pump(s) with electrically commutated motors (ECMs) or permanent split capacitor (PSC) motors is installed (full load efficiency of 90 percent or greater).	1	0	☐	

706.5		**706.5 On-site renewable energy system.** One of the following options is implemented				
	(1)	Building is Solar-Ready in compliance with IECC Appendix A Solar Ready Provisions.	**1**	0	☐ kW per 49 units:	
	(2)	An on-site renewable energy system(s) is installed on the property.	**2 per kW**	0	kWh of strg. per 49 units:	
	(3)	An on-site renewable energy system(s) and a battery energy storage system are installed on the property.	**2 per kW, 1 per 2 kWh**	0		
		Points awarded shall not be combined with points for renewable energy in another section of this chapter. Points shall not be awarded for solar thermal or geothermal systems that provide space heating, space cooling, or water heating, points for these systems are awarded in § 703. Where onsite renewable energy is included in § 702 Performance Path or 704 ERI Target Path, § 706.5 shall not be awarded. The solar-ready zone roof area in #1 is area per dwelling unit. Points in item #2 and #3 shall be divided by the number of dwelling units.				
		Multifamily Building Note: *Conditioned common area and non-residential space is excluded for the purpose of calculating number of units.*				
706.6		**706.6 Parking garage efficiency.** Structured parking garages are designed to require no mechanical ventilation for fresh air requirements.	**2**	0	☐	
706.7		**706.7 Grid-interactive electric thermal storage system.** A grid-interactive electric thermal storage system is installed.				
	(1)	Grid-Interactive Water Heating System	**1**	0	☐	
	(2)	Grid-Interactive Space Heating and cooling System	**1**	0	☐	
		(where points awarded in Section 706.7, points shall not be awarded in Section 706.3 and 706.9)				
706.8		**706.8 Electrical vehicle charging station.** A Level 2 (208/240V 40-80 amp) or Level 3 electric vehicle charging station is installed on the building site. (Note: Charging station shall not be included in the building energy consumption.)	**2**	0	☐	
706.9		**706.9 CNG vehicle fueling station.** A CNG vehicle residential fueling appliance is installed on the building site. The CNG fueling appliances shall be listed in accordance with ANSI/CSA NGV 5.1 and installed in accordance to the appliance manufacturer's installation instructions. (Note: The fueling appliance shall not be included in the building energy consumption.)	**1**	0	☐	
706.10		**706.10 Automatic demand response.** Automatic demand response system is installed that curtails energy usage upon a signal from the utility or an energy service provider is installed.	**1**	0	☐	
		(where points awarded in Section 706.10, points shall not be awarded in Section 706.3 and 706.7)				
706.11		**706.11 Grid-interactive battery storage system.** A grid-interactive battery storage system of not less than 6 kWh of available capacity is installed.	**2**	0	☐	
706.12		**706.12 Smart ventilation.** A whole-building ventilation systems is installed with automatic ventilation controls to limit ventilation during periods of extreme temperature, extreme humidity, and/or during times of peak utility loads and is in accordance with the specifications of ASHRAE Standard 62.2-2010 Section 4.	**1**	0	☐	
706.13		**706.13 Alternative refrigerant.** Use of the following in mechanical space cooling systems for dwellings.		0		
	(1)	Use alternative refrigerant with a GWP < 1000	**1**			
	(2)	Do not use refrigerants	**2**			
706.14		**706.14 Third-party utility benchmarking service.**				
	(1)	For a multifamily building, the owner has contracted with a third-party utility benchmarking service with at least five (5) years of experience in utility data management and analysis to perform a monthly analysis of whole-building energy and water consumption for a minimum of 1 year.	**3**	0	☐	
	(2)	The building owner commits to reporting energy data using U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager for a minimum of three years.	**1**	0	☐	
706.15		**706.15 Entryway air seal.** For multifamily buildings, where not required by the building or energy code, to slow the movement of unconditioned air from outdoors to indoors at the main building entrance, the following is installed:				
	(1)	Building entry vestibule.	**2**	2	☑	
	(2)	Revolving entrance doors.	**2**	0	☐	
END OF CHAPTER 7						CLICK TO PROCEED TO CHAPTER 8 >>

	Current Chapter level: Silver	Total Points: 55			
	Points away from: Bronze: 0, Silver: 0, Gold: 12, Emerald: 37				
	Add'l pts earned above: Bronze: 30, Silver: 16, Gold: 0, Emerald: 0				
	Total Chapter Points needed for: Bronze: 25, Silver: 39, Gold: 67, Emera				
	Revision Date: 3/28/2025				

NGBS GREEN
Home Innovation Research Labs

Coding

Practice #	Chapter 8: Water Efficiency	Points Available	Points Claimed	Status	Notes
801 INDOOR AND OUTDOOR WATER USE					
801.0	**801.0 Intent.** Implement measures that reduce indoor and outdoor water usage. Implement measures that include collection and use of alternative sources of water. Implement measures that treat water on site.				
801.1	**801.1 Mandatory requirements.** The building shall comply with Section 802 (Prescriptive Path) and 803 (Innovative Practices) or Section 804 (Performance Path). Points from Section 804 (Performance Path) shall not be combined with points from Section 802 (Prescriptive Path) or Section 803 (Innovative Practices). The mandatory provisions of Section 802 (Prescriptive Path) are required when using the Water Rating Index of Section 804 (Performance Path) for Chapter 8 Water Efficiency compliance.			Prescriptive Path	
802 PRESCRIPTIVE PATH					
802.1	**802.1 Indoor hot water usage.** Indoor hot water supply system is in accordance with one of the practices listed in items (1) through (5). The maximum water volume from the source of hot water to the termination of the fixture supply is determined in accordance with Tables 802.1(1) or 802.1(2). The maximum pipe length from the source of hot water to the termination of the fixture supply is 50 feet.		0		
	(Where more than one water heater is used or where more than one type of hot water supply system, including multiple circulation loops, is used, points are awarded only for the system that qualifies for the minimum number of points.)				
	(Systems with circulation loops are eligible for points only if pumps are demand controlled. Circulation systems with timers or aquastats and constant-on circulation systems are not eligible to receive points.)				
	(Points awarded only if the pipes are insulated in accordance with Section 705.6.3.)				
	See Table 802.1(1)				
	See Table 802.1(2)				
(1)	The maximum volume from the water heater to the termination of the fixture supply at furthest fixture is 128 ounces (1 gallon or 3.78 liters).	**8**			
(2)	The maximum volume from the water heater to the termination of the fixture supply at furthest fixture is 64 ounces (0.5 gallon or 1.89 liters).	**12**			
(3)	The maximum volume from the water heater to the termination of the fixture supply at furthest fixture is 32 ounces (0.25 gallon or 0.945 liters).	**20**			
(4)	A demand controlled hot water priming pump is installed on the main supply pipe of the circulation loop and the maximum volume from this supply pipe to the furthest fixture is 24 ounces (0.19 gallons or 0.71 liters).	**24**			
(a)	The volume in the circulation loop (supply) from the water heater or boiler to the branch for the furthest fixture is no more than 128 ounces (1 gallon or 3.78 liters).	**4 Additional**			
(5)	A central hot water recirculation system is implemented in multifamily buildings in which the hot water line distance from the recirculating loop to the engineered parallel piping system (i.e., manifold system) is less than 30 feet (9,144 mm) and the parallel piping to the fixture fittings contains a maximum of 64 ounces (1.89 liters) (115.50 cubic inches) (0.50 gallons).	**9**			
(6)	Tankless water heater(s) with at least 0.5 gallon (1.89 liters) of storage are installed, or a tankless water heater that ramps up to at least 110F within 5 seconds is installed. The storage may be internal or external to the tankless water heater.	**1 Additional**	0	☐	
802.2	**802.2 Water-conserving appliances.** Energy Star or equivalent water-conserving appliances are installed.				
(1)	dishwasher	**2**	2	☑	
(2)	clothes washer, or	**13**	0		
(3)	clothes washer with an Integrated Water Factor of 3.8 or less	**18**			
	NOTE: If multiple dishwashers and washing machines are installed, ALL instances must meet the above conditions to be awarded points.				
	Multifamily Building Note: Washing machines are installed in individual units or provided in common areas of multifamily buildings.				
802.3	**802.3 Water usage metering.** Water meters are installed meeting the following:				
(1)	Single-Family Buildings: Water Usage Metering:				
(a)	Where not otherwise required by the local AHJ, installation of a meter for water consumed from any source associated with the building or building site.	**2 per unique meter**	0		
(b)	Each water meter shall be capable of communicating water consumption data remotely for the dwelling unit occupant and be capable of providing daily data with electronic data storage and reporting capability that can produce reports for daily, monthly, and yearly water consumption. (Fire sprinkler systems are not required to be metered).	**2 per sensor package**	0		
(2)	Multi-Family Buildings: Water Usage Metering:				
	(Points earned in Section 802.3(2) shall not exceed 50% of the total points earned for Chapter 8)	**Points Reduced**			
(a)	Where not otherwise required by the local AHJ, installation of a meter for water consumed from any source associated with the building or building site.	**2 per unique use meter**	0		
(b)	Each water meter shall be capable of communicating water consumption data remotely for the dwelling unit occupant and be capable of providing daily data with electronic data storage and reporting capability that can produce reports for daily, monthly, and yearly water consumption. (Fire sprinkler systems are not required to be metered).	**2 per sensor package**	0		
802.4	**802.4 Showerheads.** Showerheads are in accordance with the following:			# of compartments:	
(1)	The total maximum combined flow rate of all showerheads in a shower compartment with floor area of 2600 square inches or less is equal or less than 2.0 gpm. For each additional 1300 square inches or any portion thereof of shower compartment floor area, an additional 2.0 gpm combined showerhead flow rate is allowed. Showerheads shall comply with ASME A112.18.1/CSA B125.1 and shall meet the performance criteria of the U.S. EPA WaterSense Specification for showerheads. Showerheads shall be served by an automatic compensating valve that complies with ASSE 1016/ASME A112.1016/CSA B125.16 or ASME A112.18.1/CSA B125.1 and specifically designed to provide thermal shock and scald protection at the flow rate of the showerhead.	**4 for first compartment** **1 for each additional compartment in dwelling**	4	1 compartment	1.75 gpm
	(Points awarded per shower compartment. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)	**7 Max**			
(2)	All shower compartments in the dwelling unit(s) or sleeping unit(s) and common areas meet the requirements of 802.4(1) and all showerheads are in accordance with one of the following:		6	(a)	
(a)	maximum of 1.8 gpm	**6 Additional**			
(b)	maximum of 1.5 gpm	**10 Additional**			
(3)	Any shower control that can shut off water flow without affecting temperature is installed. **(Points awarded per shower control.)**	**1** **3 Max**	0		

802.5		**802.5 Faucets**				
802.5.1		**802.5.1** Install water-efficient lavatory faucets with flow rates not more than 1.5 gpm (5.68 L/m), tested in compliance with ASME A112.18.1/CSA B125.1 and meeting the performance criteria of the EPA WaterSense High-Efficiency Lavatory Faucet Specification:		0	1 fixture	0.5 gpm
	(1)	Flow rate ≤ 1.5 gpm (*all faucets in a bathroom are in compliance) **(Points awarded for each bathroom. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)**	**1** **3 Max**			
	(2)	Flow rate ≤ 1.2 gpm (*all faucets in a bathroom are in compliance)	**2 (6 Max)**			
	(3)	Flow rate ≤ 1.5 gpm for all lavatory faucets in the dwelling unit(s) or sleeping unit(s)	**6 Additional**			
	(4)	Flow rate ≤ 1.5 gpm for all lavatory faucets in the dwelling unit(s), and at least one bathroom has faucets with flow rates ≤ 1.2 gpm	**8 Additional**			
	(5)	Flow rate ≤ 1.2 gpm for all lavatory faucets in the dwelling unit(s)	**12 Additional**			
802.5.2		**802.5.2** Water-efficient residential kitchen faucets are installed in accordance with ASME A112.18.1/CSA B125.1. Residential kitchen faucets may temporarily increase the flow above the maximum rate but not to exceed 2.2 gpm.		3	(1)	1.8 gpm
	(1)	All residential kitchen faucets have a maximum flow rate of 1.8 gpm.	**3**			
	(2)	All residential kitchen faucets have a maximum flow rate of 1.5 gpm.	**1 Additional**			
802.5.3		**802.5.3** Self-closing valve, motion sensor, metering, or pedal-activated faucet is installed to enable intermittent on/off operation. **(Points awarded per fixture.)**	**1** **3 Max**	0		
802.5.4		**802.5.4 Water closets and urinals.** Water closets and urinals are in accordance with the following:				
	(1)	Gold and emerald levels: All water closets and urinals are in accordance with Section 802.5.4.	**Met**			
	(2)	A water closet is installed with an effective flush volume of 1.28 gallons (4.85 L) or less in accordance with ASME A112.19.2/CSA B45.1 or ASME A112.19.14 as applicable. Tank-type water closets shall be in accordance with the performance criteria of the U.S. EPA WaterSense Specification for Tank-Type Toilets. **(Points awarded per fixture. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)**	**4** **12 Max**	4	1 fixture	1.28 gpf
	(3)	All water closets are in accordance with Section 802.5.4(2).	**13 Additional**	13	☑	
	(4)	All water closets are in accordance with Section 802.5.4(2) and one or more of the following are installed:				
	(a)	Water closets that have an effective flush volume of 1.2 gallons or less. **(Points awarded per toilet. In multifamily buildings, the average of the points assigned to individual dwelling units or sleeping units may be used as the number of points awarded for this practice, rounded to the nearest whole number.)**	**2 Additional** **6 Max**	0		
	(b)	One or more urinals with a flush volume of 0.5 gallons (1.9L) or less when tested in accordance with ASME A112.19.2/CSA B45.1.	**2 Additional**	0	☐	
	(c)	One or more composting or waterless toilets and/or nonwater urinals. Nonwater urinals shall be tested in accordance with ASME A112.19.2/CSA B45.1.	**12 Additional**	0	☐	
802.6		**802.6 Irrigation systems**				
802.6.1		**802.6.1** Where an irrigation system is installed, an irrigation plan and implementation are executed by a qualified professional or equivalent.	**N/A**		N/A	No irrigation
802.6.2		**802.6.2** Irrigation sprinkler nozzles shall be tested according to ANSI standard ASABE/ICC 802-2014 Landscape Irrigation Sprinkler and Emitter Standard by an accredited third party laboratory.	**6**	0	☐	
802.6.3		**802.6.3** Drip irrigation is installed.				
	(1)	Drip irrigation is installed for all landscape beds.	**4**	0	☐	
	(2)	Subsurface drip is installed for all turf grass areas.	**4**	0	☐	
	(3)	Drip irrigation zones specifications show plant type by name and water use/need for each emitter (Points awarded only if specifications are implemented.)	**5**	0	☐	
802.6.4		**802.6.4** The irrigation system(s) is controlled by a smart controller or no irrigation is installed. **(Points are not additive.)**				
	(1)	Irrigation controllers shall be in accordance with the performance criteria of the EPA WaterSense program	**10**	0	☐	
	(2)	No irrigation is installed and a landscape plan is developed in accordance with Section 503.5, as applicable. NOTE: 5 Points must be taken in 503.5(1)-(7) for a Full Landscape Plan in order to receive points for 802.6.4(2).	**15**	15	☑	
802.6.5		**802.6.5 Commissioning and water use reduction for irrigation systems.** *[Points are not additive per each section.]*				
	(1)	All irrigation zones utilize pressure regulation so emission devices (sprinklers and drip emitters) operate at manufacturer's recommended operating pressure.	**3**	0	☐	
	(2)	Where dripline tubing is installed, a filter with mesh size in accordance with the manufacturer's recommendation is installed on all drip zones.	**3**	0	☐	
	(3)	Utilize spray bodies that incorporate an in-stem or external flow shut-off device.	**3**	0	☐	
	(4)	For irrigation systems installed on sloped sites, either an in-stem or external check valve is utilized for each spray body.	**3**	0	☐	
	(5)	Where an irrigation system is installed, a flow sensing device is installed to monitor and alert the controller when flows are outside design range.	**3**	0	☐	
802.7		**802.7 Rainwater collection and distribution.** Rainwater collection and distribution is provided.				
802.7.1		**802.7.1** Rainwater is used for irrigation in accordance with one of the following:		0		
	(1)	Rainwater is diverted for landscape irrigation without impermeable water storage	**5**			
	(2)	Rainwater is diverted for landscape irrigation with impermeable water storage in accordance with one of the following:				
	(a)	50 – 499 gallon storage capacity	**5**			
	(b)	500 – 2499 gallon storage capacity	**10**			
	(c)	2500 gallon or larger storage capacity (system is designed by a professional certified by The American Rainwater Catchment Systems Association or equivalent)	**15**			
	(d)	All irrigation demands are met by rainwater capture (documentation demonstrating the water needs of the landscape is provided and the system is designed by a professional certified by The American Rainwater Catchment Systems Association or equivalent).	**25**			
802.7.2		**802.7.2** Rainwater is used for indoor domestic demand as follows. The system is designed by a professional certified by The American Rainwater Catchment Systems Association or equivalent.		0		
	(1)	Rainwater is used to supply an indoor appliance or fixture for any locally approved use. **(Points awarded per appliance or fixture.)**	**5** **15 Max**			
	(2)	Rainwater provides for total domestic demand.	**25**		☐	

802.8		**802.8 Sediment filters.** Water filter is installed to reduce sediment and protect plumbing fixtures for the whole building or the entire dwelling unit.	**1**	0	☐	
802.9		**802.9 Water treatment devices.**				
802.9.1		**802.9.1** Water Softeners shall not be installed where the supplied water hardness is less than 8.0 grains per gallon measured as total calcium carbonate equivalents. Water softeners shall be listed to NSF 44 and a rated salt efficiency of 3400 grains of total hardness per 1.0 pound of salt based on sodium chloride equivalency. Devices shall not discharge more than 4.0 gallons of water per 1000 grains of hardness removed during the service or recharge cycle.		5	(1)	not in plans
	(1)	No water softener.	**5**			
	(2)	Water softener installed to supply softened water only to domestic water heater.	**2**			
802.9.2		**802.9.2** Reverse Osmosis (R/O) water treatment systems shall be listed to NSF 58 and shall include automatic shut-off valve to prevent water discharge when storage tank is full.		3	(1)	not in plans
	(1)	No R/O system.	**3**			
	(2)	Combined capacity of all R/O systems does not exceed 0.75 gallons.	**1**			
802.10		**802.10 Pools and spas.**				
802.10.1		**802.10.1** Pools and Spas with water surface area greater than 36 square feet and connected to a water supply shall have a dedicated meter to measure the amount of water supplied to the pool or spa.	**Mandatory**		N/A	no pools or spas
	(1)	Automated motorized non-permeable pool cover that covers the entire pool surface.	**10**	0	☐	
803 INNOVATIVE PRACTICES						
803.1		**803.1 Reclaimed, gray, or recycled water**. Reclaimed, gray, or recycled water is used as permitted by applicable code. **(Points awarded for either Section 803.1(1) or 803.1(2), not both.)** **(Points awarded for either Section 803.6 or 803.1, not both.)**		0		
	(1)	each water closet flushed by reclaimed, gray, or recycled water **(Points awarded per fixture or appliance.)**	**5** **20 Max**			
	(2)	irrigation from reclaimed, gray, or recycled water on-site	**10**		☐	
803.2		**803.2 Reclaimed water, graywater, or rainwater pre-piping.** Reclaimed, graywater, or rainwater systems are rough plumbed (and permanently marked, tagged or labeled) into buildings for future use.	**3 per roughed in system**	0	# of systems:	
803.3		**803.3 Automatic leak detection and control devices.** One of the following devices is installed. Where a fire sprinkler system is present, ensure the device will be installed to not interfere with the operation of the fire sprinkler system.	**2**	0		
	(1)	automatic water leak detection and control devices				
	(2)	automatic water leak detection and shutoff devices				
803.4		**803.4 Engineered biological system or intensive bioremediation system.** An engineered biological system or intensive bioremediation system is installed and the treated water is used on site. Design and implementation are approved by appropriate regional authority.	**20**	0	☐	
803.5		**803.5 Recirculating humidifier.** Where a humidifier is required, a recirculating humidifier is used in lieu of a traditional "flow through" type.	**1**	0	☐	
803.6		**803.6 Advanced wastewater treatment system.** Advanced wastewater (aerobic) treatment system is installed and treated water is used on site. **(Points awarded for either Section 803.6 or 803.1, not both.)**	**20**	0	☐	
804 PERFORMANCE PATH						
804.1		**804.1 Performance Path.** The index score for the Performance Path shall be calculated in accordance with Appendix D Water Rating Index (WRI) or equivalent methodology.	**None**		WRI	
804.2		**804.2 Water efficiency rating levels.** In lieu of threshold levels for Chapter 8 in Table 303, rating levels for Section 804.1 are in accordance with Table 804.2.				
804.3		**804.3 Water efficiency NGBS points equivalency.** The additional points for use with Table 303 from the Chapter 8 Water Efficiency Category are determined in accordance with equation 804.3. **Equation 804.3** **NGBS = WRI x (-2.29) + 181.7**		0		
END OF CHAPTER 8						CLICK TO PROCEED TO CHAPTER 9 >>

		Current Chapter level: Silver	**Total Points: 58**			
		Points away from: Bronze: 0, Silver: 0, Gold: 11, Emerald: 39				
		Add'l pts earned above: Bronze: 33, Silver: 16, Gold: 0, Emerald: 0				
		Total Chapter Points needed for: Bronze: 25, Silver: 42, Gold: 69, Emera				
		Revision Date: 3/28/2025				
Coding	Practice #	Chapter 9: Indoor Environmental Quality	Points Available	Points Claimed	Status	Notes
		901 POLLUTANT SOURCE CONTROL				
	901.0	**901.0 Intent.** Pollutant sources are controlled.				
	901.1	**901.1 Space and water heating options**				
	901.1.1	**901.1.1** Natural draft furnaces, boilers, or water heaters are not located in conditioned spaces, including conditioned crawlspaces, unless located in a mechanical room that has an outdoor air source and is sealed and insulated to separate it from the conditioned space(s). **(Points are awarded only for buildings that use natural draft combustion space or water heating equipment.)**	5	0	☐	
	901.1.2	**901.1.2** Air handling equipment or return ducts are not located in the garage, unless placed in isolated, air-sealed mechanical rooms with an outside air source. Not available if there is no attached garage	5	0	☐	
	901.1.3	**901.1.3** The following combustion space heating or water heating equipment is installed within conditioned space:				
	(1)	all furnaces or all boilers		0		
	(a)	power vent furnace(s) or boiler(s)	3			
	(b)	direct vent furnace(s) or boiler(s)	5			
	(2)	all water heaters		0		
	(a)	power vent water heater(s)	3			
	(b)	direct vent water heater(s)	5			
	901.1.4	**901.1.4** Gas-fired fireplaces and direct heating equipment is listed and is installed in accordance with the NFPA 54, ICC IFGC, or the applicable local gas appliance installation code. Gas-fired fireplaces within dwelling units or sleeping units and direct heating equipment are vented to the outdoors. Alcohol burning devices and kerosene heaters are vented to the outdoors.	Mandatory		N/A	
	901.1.5	**901.1.5** Natural gas and propane fireplaces are direct vented, have permanently fixed glass fronts or gasketed doors, and comply with CSA Z21.88/CSA 2.33 or CSA Z21.50b/CSA 2.22b.	7	0	☐	
	901.1.6	**901.1.6** The following electric equipment is installed:		2	(1)	verify
	(1)	heat pump air handler in unconditioned space	2			
	(2)	heat pump air handler in conditioned space	5			
	901.2	**901.2 Solid fuel-burning appliances**				
	901.2.1	**901.2.1** Solid fuel-burning fireplaces, inserts, stoves and heaters are code compliant and are in accordance with the following requirements:				
	(1)	Site-built masonry wood-burning fireplaces use outside combustion air and include a means of sealing the flue and the combustion air outlets to minimize interior air (heat) loss when not in operation.	N/A 4	0		
	(2)	Factory-built, wood-burning fireplaces are in accordance with the certification requirements of UL 127 and are an EPA Phase 2 Emission Level Qualified Model.	N/A 6	0		
	(3)	Wood stove and fireplace inserts, as defined in UL 1482 Section 3.8, are in accordance with the certification requirements of UL 1482 and are in accordance with the emission requirements of the EPA Certification and the State of Washington WAC 173-433-100(3).	N/A 6	0		
	(4)	Pellet (biomass) stoves and furnaces are in accordance with ASTM E1509 or are EPA certified.	N/A 6	0		
	(5)	Masonry heaters are in accordance with the definitions in ASTM E1602 and ICC IBC Section 2112.1.	N/A 6	0		
	901.2.2	**901.2.2** Fireplaces, woodstoves, pellet stoves, or masonry heaters are not installed.	6	6	☑	
	901.3	**901.3 Garages.** Garages are in accordance with the following:				
	(1)	Attached garage				
	(a)	Doors installed in the common wall between the attached garage and conditioned space are tightly sealed and gasketed.	N/A 2	0		
	(b)	A continuous air barrier is provided separating the garage space from the conditioned living spaces.	N/A 2	0		
	(c)	For one- and two-family dwelling units, a 100 cfm (47 L/s) or greater ducted or 70 cfm (33 L/s) cfm or greater unducted wall exhaust fan is installed and vented to the outdoors and is designed and installed for continuous operation or has controls (e.g., motion detectors, pressure switches) that activate operation for a minimum of 1 hour when either human passage door or roll-up automatic doors are operated. For ducted exhaust fans, the fan airflow rating and duct sizing are in accordance with ASHRAE Standard 62.2-2007 Section 7.3.	8	0	☐	
	(2)	A carport is installed, the garage is detached from the building, or no garage is installed.	10	10	☑	
	901.4	**901.4** Wood materials. A minimum of 85 percent of material within a product group (i.e., wood structural panels, countertops, composite trim/doors, custom woodwork, and/or component closet shelving) is manufactured in accordance with the following:	10 Max	0		
	(1)	Structural plywood used for floor, wall, and/or roof sheathing is compliant with DOC PS 1 and/or DOC PS 2. OSB used for floor, wall, and/or roof sheathing is compliant with DOC PS 2. The panels are made with moisture-resistant adhesives. The trademark indicates these adhesives as follows: Exposure 1 or Exterior for plywood, and Exposure 1 for OSB. NOTE: If "N/A" is selected, please explain in the Notes area.	Mandatory		Met	verify
		Countertops				
		Composite trim/doors				
		Custom woodwork				
		Component closet shelving				
	(2)	Particleboard and MDF (medium density fiberboard) is manufactured and labeled in accordance with CPA A208.1 and CPA A208.2, respectively.	2			
	(3)	Hardwood plywood in accordance with HPVA HP-1.	2			
	(4)	Particleboard, MDF, or hardwood plywood is in accordance with CPA 4.	3			
	(5)	Composite wood or agrifiber panel products contain no added urea-formaldehyde or are in accordance with the CARB *Composite Wood Air Toxic Contaminant Measure Standard* .	4			
	(6)	Non-emitting products.	4			
	901.5	**901.5 Cabinets.** A minimum of 85 percent of installed cabinets are in accordance with one or both of the following: **(Where both of the following practices are used, only 3 points are awarded.)**				
	(1)	All parts of the cabinet are made of solid wood or non-formaldehyde emitting materials such as metal or glass.	5	0	☐	
	(2)	The composite wood used in wood cabinets is in accordance with CARB *Composite Wood Air Toxic Contaminant Measure Standard* or equivalent as certified by a third-party program such as, but not limited to, those in Appendix B.	3	0	☐	no indication cabinets are CARB
	901.6	**901.6 Carpets.** Wall-to-wall carpeting is not installed adjacent to water closets and bathing fixtures.	Mandatory		☑	bathrooms are sheet vinyl

901.7		**901.7 Floor materials.** The following types of finished flooring materials are used. The materials have emission levels in accordance with CDPH/EHLB Standard Method v1.1. Product is tested by a laboratory with the CDPH/EHLB Standard Method v1.1 within the laboratory scope of accreditation to ISO/IEC 17025 and certified by a third-party program accredited to ISO 17065, such as, but not limited to, those in Appendix B.	**1** **8 Max**	0			
		(Points are awarded for every 10% of conditioned floor space using one of the below materials.)			actual %:		
	(1)	Hard surface flooring: Prefinished installed hard-surface flooring is installed. Where post-manufacture coatings or surface applications have not been applied, the following hard surface flooring types are deemed to comply with the emission requirements of this practice:					
	(a)	Ceramic tile flooring					
	(b)	Organic-free, mineral-based flooring					
	(c)	Clay masonry flooring					
	(d)	Concrete masonry flooring					
	(e)	Concrete flooring					
	(f)	Metal flooring			actual %'s:		
	(2)	Carpet meeting and carpet cushion not meeting the emission limits is installed.					
	(3)	Carpet and carpet cushion meeting the emission limits is installed.					
		(When carpet cushion meeting the emission limits of the practice is also installed, the percentage of compliant carpet area is calculated at 1.33 times the actual installed area.)					
901.8		**901.8 Wall coverings.** A minimum of 10 percent of the interior wall surfaces are covered and a minimum of 85 percent of wall coverings are in accordance with the emission concentration limits of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 17025 and the CDPH/EHLB Standard Method v1.1 is in its scope. The product is certified by a third-party program accredited to ISO 17065, such as, but not limited to, those in Appendix B.	**4**	0	☐		
901.9		**901.9 Interior architectural coatings.** A minimum of 85 percent of the interior architectural coatings are in accordance with either Section 901.9.1 or Section 901.9.3, not both. A minimum of 85 percent of architectural colorants are in accordance with Section 901.9.2.					
901.9.1		**901.9.1** Site-applied interior architectural coatings, which are inside the water proofing envelope, are in accordance with one or more of the following:	**5**	5			
	(1)	Zero VOC as determined by EPA Method 24 (VOC content is below the detection limit for the method)			☑		verify
	(2)	GreenSeal GS-11			☐		
	(3)	CARB *Suggested Control Measure for Architectural Coatings* (see Table 901.9.1). See Table 901.9.1			☐		
901.9.2		**901.9.2** Architectural coating colorant additive VOC content is in accordance with Table 901.9.2.	**1**	1	☑		verify
		(Points for 901.9.2 are awarded only if base architectural coating is in accordance with 901.9.1.)					
		See Table 901.9.2					
901.9.3		**901.9.3** Site-applied interior architectural coatings, which are inside the waterproofing envelope, are in accordance with the emission levels of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 17025 and the CDPH/EHLB Standard Method v1.1 in its scope of accreditation. The product is certified by a third-party program accredited to ISO 17065, such as, but not limited to, those found in Appendix B.	**8**	0	☐		
901.10		**901.10 Interior adhesives and sealants.** A minimum of 85 percent of site-applied adhesives and sealants located inside the waterproofing envelope are in accordance with one of the following, as applicable.		0			
	(1)	The emission levels are in accordance with CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 17025 and the CDPH/EHLB Standard Method v1.1 is in its scope of accreditation. The product is certified by a third-party program accredited to ISO 17065, such as, but not limited to, those found in Appendix B.	**8**		☐		
	(2)	GreenSeal GS-36.	**5**		☐		
	(3)	SCAQMD Rule 1168 in accordance with Table 901.10(3), excluding products that are sold in 16 ounce containers or less and are regulated by the California Air Resources Board (CARB) Consumer Products Regulations. See Table 901.10(3)	**5**		☐		
901.11		**901.11 Insulation.** Emissions of 85 percent of wall, ceiling, and floor insulation materials are in accordance with the emission levels of CDPH/EHLB Standard Method v1.1. Emission levels are determined by a laboratory accredited to ISO/IEC 17025 and the CDPH/EHLB Standard Method v1.1 is in its scope of accreditation. Insulation is certified by a third-party program accredited to ISO 17065, such as, but not limited to, those in Appendix B.	**4**	0	☐		
901.12		**901.12 Furniture and Furnishings.** In a multifamily building, all furniture in common areas shall have VOC emission levels in accordance with ANSI/BIFMA e3-Furniture Sustainability Standard sections 7.6.1 and 7.6.2, tested in accordance with ANSI/BIFMA Standard Method M7.1.	**2**	0	☐		
901.13		**901.13 Carbon monoxide (CO) alarms.** A carbon monoxide (CO) alarm is provided in accordance with the IRC Section R315.	**Mandatory**		Built to IBC		
901.14		**901.14 Building entrance pollutants control.** Pollutants are controlled at all main building entrances by one of the following methods:		0			
	(1)	Exterior grilles or mats are installed in a fixed manner and may be removable for cleaning.	**1**		☐		
	(2)	Interior grilles or mats are installed in a fixed manner and may be removable for cleaning.	**1**		☐		
901.15		**901.15 Non-smoking areas.** Environmental tobacco smoke is minimized by one or more of the following:					
	(1)	All interior common areas of a multifamily building are designated as non-smoking areas with posted signage.	**1**	0	☐		any signage?
	(2)	Exterior smoking areas of a multifamily building are designated with posted signage and located a minimum of 25 feet from entries, outdoor air intakes, and operable windows.	**1**	0	☐		any signage?

902 POLLUTANT CONTROL

902.0		**902.0 Intent.** Pollutants generated in the building are controlled.				
902.1		**902.1 Spot ventilation.**				
902.1.1		**902.1.1** Spot ventilation is in accordance with the following:				
	(1)	Bathrooms are vented to the outdoors. The minimum ventilation rate is 50 cfm (23.6 L/s) for intermittent operation or 20 cfm (9.4 L/s) for continuous operation in bathrooms.	**Mandatory**		☑	intermittant @ 50 cfm
	(a)	A window complying with IRC Section R303.3 is provided in addition to mechanical ventilation.	**1**	0	☐	
	(2)	Clothes dryers (except listed and labeled condensing ductless dryers) are vented to the outdoors.	**Mandatory**		Met	verify
	(3)	Kitchen exhaust units and/or range hoods are ducted to the outdoors and have a minimum ventilation rate of 100 cfm (47.2 L/s) for intermittent operation or 25 cfm (11.8 L/s) for continuous operation.	**8**	8	☑	verify
902.1.2		**902.1.2** Bathroom and/or laundry exhaust fan is provided with an automatic timer and/or humidistat:	**11 Max**	0	# of timers:	
	(1)	for first device	**5**		# of humidistats:	
	(2)	for each additional device	**2**			
902.1.3		**902.1.3** Kitchen range, bathroom, and laundry exhaust are verified to air flow specification. Ventilation airflow at the point of exhaust is tested to a minimum of:	**8**	8	☑	
	(a)	100 cfm (47.2 L/s) intermittent or 25 cfm (11.8 L/s) continuous for kitchens, and				
	(b)	50 cfm (23.6 L/s) intermittent or 20 cfm (9.4 L/s) continuous for bathrooms and/or laundry				
902.1.4		**902.1.4** Exhaust fans are ENERGY STAR, as applicable.	**12 Max**	6		Kitchen and bath exhaust both ES < 0.9 sone
	(1)	ENERGY STAR, or equivalent, fans operating above 1 sone **(Points awarded per fan.)**	**2**		# of fans:	
	(2)	ENERGY STAR, or equivalent, fans operating at or below 1 sone **(Points awarded per fan.)**	**3**		2 fan(s)	
902.1.5		**902.1.5** Fenestration in spaces other than those identified in 902.1.1 through 902.1.4 are designed for stack effect or cross-ventilation in accordance with all of the following:	**3**	0		
	(1)	Operable windows, operable skylights, or sliding glass doors with a total area of at least 15 percent of the total conditioned floor area are provided.			☐	
	(2)	Insect screens are provided for all operable windows, operable skylights, and sliding glass doors.			☑	
	(3)	A minimum of two operable windows or sliding glass doors are placed in adjacent or opposite walls. If there is only one wall surface in that space exposed to the exterior, the minimum windows or sliding glass doors may be on the same wall.			☐	
902.1.6		**902.1.6 Ventilation for Multifamily Common Spaces.** Systems are implemented and are in accordance with the specifications of ASHRAE 62.1 and an explanation of the operation and importance of the ventilation system is included in 1002.1 and 1002.2 of NGBS.	**3**	3	☑	
902.2		**902.2 Building ventilation systems.**				
902.2.1		**902.2.1** One of the following whole building ventilation systems is implemented and is in accordance with the specifications of ASHRAE Standard 62.2-2010 Section 4 and an explanation of the operation and importance of the ventilation system is **included in either 1001.1(9) or 1002.2(11)**.	**Mandatory**	3	(1)	verify
	(1)	exhaust or supply fan(s) ready for continuous operation and with appropriately labeled controls	**3**			
	(2)	balanced exhaust and supply fans with supply intakes located in accordance with the manufacturer's guidelines so as to not introduce polluted air back into the building	**6**			
	(3)	heat-recovery ventilator	**7**			
	(4)	energy-recovery ventilator	**8**			
	(5)	Ventilation air is preconditioned by a system not specified above	**10**			
902.2.2		**902.2.2** Ventilation airflow is tested to achieve the design fan airflow in accordance with ANSI/RESNET/ICC 380 and Section 902.2.1.	**4**	0	☐	
902.2.3		**902.2.3** MERV filters 8 to 13 are installed on central forced air systems and are accessible. Designer or installer is to verify that the HVAC equipment is able to accommodate the greater pressure drop of MERV 8 to 13 filters.	**2**	0	☐	
902.2.4		**902.2.4** MERV filters 14 or greater are installed on central forced air systems and are accessible. Designer or installer is to verify that the HVAC equipment is able to accommodate the greater pressure drop of the filter used.	**3**	0	☐	

902.3		**902.3 Radon reduction measures.** Radon reduction measures are in accordance with ICC IRC Appendix F or 902.3.1. Radon Zones as identified by the AHJ or, if the zone is not identified by the AHJ, as defined in Figure 9(1).	Mandatory		ICC IRC F	
	(1)	Buildings located in Zone 1		0		
	(a)	a passive radon system is installed	N/A			
	(b)	an active radon system is installed	12			
	(2)	Buildings located in Zone 2 or Zone 3		6		
	(a)	a passive radon system is installed	6			
	(b)	an active radon system is installed	12			
902.3.1		**902.3.1 Radon reduction option.** This option requires section 902.3.1.1 through 902.3.1.7.				
902.3.1.1		**902.3.1.1 Soil-gas barriers and base course.** A base course in accordance with Section 506.2.2 of the IRC shall be installed below slabs and foundations. There shall be a continuous gas-permeable base course under each soil-gas retarder that is separated by foundation walls or footings. Between slabs and the base course, damp proofing or water proofing shall be installed in accordance with Section 406 of the IRC. Punctures, tears and gaps around penetrations of the soil-gas retarder shall be repaired or covered with an additional soil-gas retarder. The soil-gas retarder shall be a continuous6-mil (0.15 mm) polyethylene or an approved equivalent.				
902.3.1.2		**902.3.1.2 Soil gas collection.** There shall be an unobstructed path for soil gas flow between the void space installed in the base course and the vent through the roof. Soil gases below the foundation shall be collected by a perforated pipe with a diameter of not less than 4 inches (10 cm) and not less than 5 feet (1.5 m) in total length. A tee fitting or equivalent method shall provide two horizontal openings to the radon collection. The tee fitting shall be designed to prevent clogging of the radon collection path. Alternately the soil gas collection shall be by approved radon collection mats or an equivalent approved method.				
902.3.1.3		**902.3.1.3 Soil gas entry routes.** Openings in slabs, soil-gas retarders, and joints such as, but not limited to, plumbing, ground water control systems, soil-gas vent pipes, piping and structural supports, shall be sealed against air leakage at the penetrations. The sealant shall be a polyurethane caulk, expanding foam or other approved method. Foundation walls shall comply with Section 103.2.3 of the IRC. Sumps shall be sealed in accordance with Section 103.2.2 of the IRC. Sump pits and sump lids intended for ground water control shall not be connected to the sub-slab soil-gas exhaust system.				
902.3.1.4		**902.3.1.4 Soil gas vent.** A gas-tight pipe vent shall extend from the soil gas permeable layer though the roof. The vent pipe size shall not be reduced at any location as it goes from gas collection to the roof. Exposed and visible interior vent pipes shall be identified with not less than one label reading "Radon Reduction System" on each floor and in habitable attics.				
902.3.1.5		**902.3.1.5 Vent pipe diameter.** The minimum vent pipe diameter shall be as specified in Table 902.3.2.5.				
902.3.1.6		**902.3.1.6 Multiple vented areas.** In dwellings where interior footings or other barriers separate the soil-gas permeable layer, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.				
902.3.1.7		**902.3.1.7 Fan.** Each sub-slab soil-gas exhaust system shall include a fan, or dedicated space for the post-construction installation of a fan. The electrical supply for the fan shall be located within 6 feet (1.8 m) of the fan. Fan is not required to be on a dedicated circuit.				
902.3.2		**902.3.2 Radon testing.** Radon testing is mandatory for Zone 1.	N/A			
		Exceptions:			Exception:	
		(2) Testing is not mandatory where the occupied space is located above an unenclosed open space.			☐	
	(1)	Testing specifications. Testing is performance as specified in (a) through (j).	8	0	☐	
	(a)	Testing is performed after the residence passes its airtightness test.			Test results (pCi/L):	
	(b)	Testing is performed after the radon control system installation is complete. If the system has an active fan, the residence shall be tested with the fan operating.				
	(c)	Testing is performed at the lowest level within a dwelling unit which will be occupied, even if the space is not finished.				
	(d)	Testing is not performed in a closet, hallway, stairway, laundry room, furnace room, kitchen or bathroom.				
	(e)	Testing is performed with a commercially available test kit or with a continuous radon monitor that can be calibrated. Testing shall be in accordance with the testing device manufacturer's instructions.				
	(f)	Testing shall be performed by the builder, a registered design professional, or an approved third party.				
	(g)	Testing shall extend at least 48 hours or to the minimum specified by the manufacturer, which ever is longer.				
	(h)	Written radon test results shall be provided by the test lab or testing party. Written test results shall be included with construction documents.				
	(i)	An additional pre-paid test kit shall be provided for the homeowner to use when they choose. The test kit shall include mailing or emailing the results from the testing lab to the homeowner.				
	(j)	Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed.				
	(2)	Testing results. A radon test done in accordance with 902.3.1 and completed before occupancy receives a results of 2 pCi/L or less.	6	0		
902.4		**902.4 HVAC system protection.** One of the following HVAC system protection measures is performed.	3	0		
	(1)	HVAC supply registers (boots), return grilles, and rough-ins are covered during construction activities to prevent dust and other pollutants from entering the system.			☐	
	(2)	Prior to owner occupancy, HVAC supply registers (boots), return grilles, and duct terminations are inspected and vacuumed. In addition, the coils are inspected and cleaned and the filter is replaced if necessary.			☐	
	(3)	If HVAC systems are to be operated, during construction, all return grilles have a temporary MERV 8 or higher filter installed in a manner ensuring no leakage around the filter.			☐	
902.5		**902.5 Central vacuum systems.** Central vacuum system is installed and vented to the outside.	3	0	☐	
902.6		**902.6 Living space contaminants.** The living space is sealed in accordance with Section 701.4.3.1 to prevent unwanted contaminants.	Mandatory		☑	
903 MOISTURE MANAGEMENT: VAPOR, RAINWATER, PLUMBING, HVAC						
903.0		**903.0 Intent.** Moisture and moisture effects are controlled.				
903.1		**903.1 Plumbing.** Plumbing is in accordance with one of the following.		0		
	(1)	Cold water pipes in unconditioned spaces are insulated to a minimum of R-4 with pipe insulation or other covering that adequately prevents condensation.	2			
	(2)	Plumbing is not installed in unconditioned spaces.	5			
903.2		**903.2 Duct insulation.** Ducts are in accordance with one of the following.		0		
	(1)	All HVAC ducts, plenums, and trunks are located in conditioned space.	1			
	(2)	All HVAC ducts, plenums, and trunks are in conditioned space. All HVAC ducts are insulated to a minimum of R4.	3			
903.3		**903.3 Relative humidity.** In climate zones 1A, 2A, 3A, 4A, and 5A, equipment is installed to maintain relative humidity (RH) at or below 60 percent using one of the following:	7	0		
	(1)	additional dehumidification system(s)			☐	
	(2)	central HVAC system equipped with additional controls to operate in dehumidification mode			☐	

904 INDOOR AIR QUALITY						
904.0		**904.0 Intent.** IAQ is protected by best practices to control ventilation, moisture, pollutant sources and sanitation.				
904.1		**904.1 Indoor Air Quality (IAQ) During Construction.** Wood is dry before close-in (602.1.7.1(3)), materials comply with emission criteria (901.4- 901.11), sources of water infiltration or condensation observed during construction have been eliminated, accessible interior surfaces are dry and free of visible suspect growth (per ASTM D7338-10 section 6.3), and water damage (per ASTM D7338-10 section 7.4.3).	**2**	0	☐	
904.2		**904.2 Indoor Air Quality (IAQ) Post Completion.** Verify there are no moisture, mold, and dust issues per 602.1.7.1(3), 901.4-901.11, ASTM D7338 Section 6.3, and ASTM D7338 Section 7.4.3.	**3**	0	☐	
904.3		**904.3 Microbial growth & moisture inspection and remediation.** A visual inspection is performed to confirm the following:				
	(1)	Verify that no visible signs of discoloration and microbial growth on ceilings, walls or floors, or other building assemblies Or If minor microbial growth is observed (less than within a total area of 25 square feet) in homes or multifamily buildings, reference EPA Document 402-K-02-003 (A Brief Guide to Mold, Moisture, and Your Home) for guidance on how to properly remediate the issue. If microbial growth is observed, on a larger scale in homes or multifamily buildings (greater than 25 sq ft), reference EPA document 402-k-01-001 (Mold Remediation in Schools and Commercial Buildings) for guidance on how to properly remediate the issue.	**Mandatory**		☑	
	(2)	Verify that there are no visible signs of water damage or pooling. If signs of water damage or pooling are observed, verify that the source of the leak has been repaired, and that damaged materials are either properly dried or replaced as needed.	**Mandatory**		☑	
905 INNOVATIVE PRACTICES						
905.1		**905.1 Humidity monitoring system.** A humidity monitoring system is installed with a mobile base unit that displays readings of temperature and relative humidity. The system has a minimum of two remote sensor units. One remote sensor unit is placed permanently inside the conditioned space in a central location, excluding attachment to exterior walls, and another remote sensor unit is placed permanently outside of the conditioned space.	**2**	0	☐	
905.2		**905.2 Kitchen exhaust.** A kitchen exhaust unit(s) that equals or exceeds 400 cfm (189 L/s) is installed, and makeup air is provided.	**2**	0	☐	
905.3		**905.3 Enhanced air filtration.** Meet all of the following.	**2**	0		
	(1)	Design for and install a secondary filter rack space for activated carbon filters.			☐	
	(2)	Provide the manufacturer's recommended filter maintenance schedule to the homeowner or building manager.			☐	
905.4		**905.4 Sound barrier.** Provide room-to-room privacy between bedrooms and adjacent living spaces within dwelling units or homes by achieving an articulation index (AI) between 0 and 0.15 per the criteria below. *Articulation Index 0 to 0.05 = STC greater than 55 (NIC greater than 47)* *Articulation Index 0.05 to 0.15 = STC 52 to 55 (NIC 44 to 47)*	**1 SF / 4 MF**	0	☐	
905.5		**905.5 Evaporative coil mold prevention.** For buildings with a mechanical system for cooling, ultraviolet lamps are installed on the cooling coils and drain pans of the mechanical system supplies. Lamps produce ultraviolet radiation at a wavelength of 254 nm so as not to generate ozone. Lamps have ballasts housed in a NEMA-rated enclosure.	**2**	0	☐	
END OF CHAPTER 9						CLICK TO PROCEED TO CHAPTER 10 >>

	Current Chapter level: Emerald	**Total Points: 20**			
	Points away from: Bronze: 0, Silver: 0, Gold: 0, Emerald: 0				
	Add'l pts earned above: Bronze: 12, Silver: 10, Gold: 9, Emerald: 8				
	Total Chapter Points needed for: Bronze: 8, Silver: 10, Gold: 11, Emerald				
	Revision Date: 3/28/2025				

Coding

Practice #	Chapter 10: Operation, Maintenance, and Building Owner Education	Points Available	Points Claimed	Status	Notes
1001 HOMEOWNER'S MANUAL AND TRAINING GUIDELINES FOR ONE- AND TWO-FAMILY DWELLINGS					
1001.0	**1001.0 Intent.** Information on the building's use, maintenance, and green components is provided.				
1001.1	**1001.1** A homeowner's manual is provided and stored in a permanent location in the dwelling that includes the following, as available and applicable.	**1** **8 Max**	0		
	(Points awarded per two items. Points awarded for non-mandatory items.)				
(1)	A National Green Building Standard certificate with weblink and completion document.	N/A		☐	
(2)	List of green building features (can include the national green building checklist).	N/A		☐	
(3)	Product manufacturer's manuals or product data sheet for installed major equipment, fixtures, and appliances. If product data sheet is in the building owners' manual, manufacturer's manual may be attached to the appliance in lieu of inclusion in the building owners' manual.	N/A		☐	
(4)	Maintenance checklist.			☐	
(5)	Information on local recycling and composting programs.			☐	
(6)	Information on available local utility programs that purchase a portion of energy from renewable energy providers.			☐	
(7)	Explanation of the benefits of using energy-efficient lighting systems [e.g., compact fluorescent light bulbs, light emitting diode (LED)] in high-usage areas.			☐	
(8)	A list of practices to conserve water and energy.			☐	
(9)	Information on the importance and operation of the home's fresh air ventilation system.			☐	
(10)	Local public transportation options.			☐	
(11)	A diagram showing the location of safety valves and controls for major building systems.			☐	
(12)	Where frost-protected shallow foundations are used, owner is informed of precautions including: **(a)** instructions to not remove or damage insulation when modifying landscaping. **(b)** providing heat to the building as required by the ICC IRC or IBC. **(c)** keeping base materials beneath and around the building free from moisture caused by broken water pipes or other water sources.			☐	
(13)	A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure (e.g., HVAC, water-heating equipment, sealants, caulks, gutter and downspout system, shower and/or tub surrounds, irrigation system).			☐	
(14)	A photo record of framing with utilities installed. Photos are taken prior to installing insulation, clearly labeled, and included as part of the building owners' manual.			☐	
(15)	List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials.			☐	
(16)	Information on organic pest control, fertilizers, deicers, and cleaning products.			☐	
(17)	Information on native landscape materials and/or those that have low water requirements.			☐	
(18)	Information on methods of maintaining the building's relative humidity in the range of 30 percent to 60 percent.			☐	
(19)	Instructions for inspecting the building for termite infestation.			☐	
(20)	Instructions for maintaining gutters and downspouts and importance of diverting water a minimum of 5 feet away from foundation.			☐	
(21)	A narrative detailing the importance of maintenance and operation in retaining the attributes of a green-built building.			☐	
(22)	Where stormwater management measures are installed on the lot, information on the location, purpose, and upkeep of these measures.			☐	
(23)	Explanation of and benefits from green cleaning in the home.			☐	
(24)	Retrofit energy calculator that provides baseline for future energy retrofits.			☐	
1001.2	**1001. 2 Training of initial homeowners.** Initial homeowners are familiarized with the role of occupants in achieving green goals. Training is provided to the responsible party(ies) regarding equipment operation and maintenance, control systems, and occupant actions that will improve the environmental performance of the building. These include:	N/A 8	0	☐	
(1)	HVAC filters.				
(2)	Thermostat operation and programming.				
(3)	Lighting controls.				
(4)	Appliances operation.				
(5)	Water heater settings and hot water use.				
(6)	Fan controls.				
(7)	Recycling and composting practices.				
(8)	Whole-dwelling mechanical ventilation systems.				
1002 CONSTRUCTION, OPERATION, AND MAINTENANCE MANUALS AND TRAINING FOR MULTI-UNIT BUILDINGS					
1002.0	**1002.0 Intent.** Manuals are provided to the responsible parties (owner, management, tenant, and/or maintenance team) regarding the construction, operation, and maintenance of the building. Paper or digital format manuals are to include information regarding those aspects of the building's construction, maintenance, and operation that are within the area of responsibilities of the respective recipient. One or more responsible parties are to receive a copy of all documentation for archival purposes.				
1002.1	**1002.1 Building construction manual.** A building construction manual, including five or more of the following, is compiled and distributed in accordance with Section 1002.0.	**1**	2	Build-to-Rent? ☐	
	(Points awarded per two items. Points awarded for non-mandatory items.)				
(1)	A narrative detailing the importance of constructing a green building, including a list of green building attributes included in the building. This narrative is included in all responsible parties' manuals.	Mandatory		☑	
(2)	A local green building program certificate as well as a copy of the *National Green Building Standard*™, as adopted by the Adopting Entity, and the individual measures achieved by the building.	Mandatory		☑	
(3)	Warranty, operation, and maintenance instructions for all equipment, fixtures, appliances, and finishes.	Mandatory		☑	
(4)	Record drawings of the building.			☑	
(5)	A record drawing of the site including stormwater management plans, utility lines, landscaping with common name and genus/species of plantings.			☑	
(6)	A diagram showing the location of safety valves and controls for major building systems.			☑	
(7)	A list of the type and wattage of light bulbs installed in light fixtures.			☑	
(8)	A photo record of framing with utilities installed. Photos are taken prior to installing insulation and clearly labeled.			☑	

1002.2		**1002.2 Operations manual.** Operations manuals are created and distributed to the responsible parties in accordance with Section 1002.0. Between all of the operation manuals, five or more of the following options are included.	1	3	Build-to-Rent? ☐	
		(Points awarded per two items. Points awarded for non-mandatory items.)				
	(1)	A narrative detailing the importance of operating and living in a green building. This narrative is included in all responsible parties' manuals.	Mandatory		☑	
	(2)	A list of practices to conserve water and energy (e.g., turning off lights when not in use, switching the rotation of ceiling fans in changing seasons, purchasing ENERGY STAR appliances and electronics).	Mandatory		☑	
	(3)	Information on methods of maintaining the building's relative humidity in the range of 30 percent to 60 percent.			☐	
	(4)	Information on opportunities to purchase renewable energy from local utilities or national green power providers and information on utility and tax incentives for the installation of on-site renewable energy systems.			☐	
	(5)	Information on local and on-site recycling and hazardous waste disposal programs and, if applicable, building recycling and hazardous waste handling and disposal procedures.			☐	
	(6)	Local public transportation options.			☑	
	(7)	Explanation of the benefits of using compact fluorescent light bulbs, LEDs, or other high-efficiency lighting.			☑	
	(8)	Information on native landscape materials and/or those that have low water requirements.			☑	
	(9)	Information on the radon mitigation system, where applicable.			☑	
	(10)	A procedure for educating tenants in rental properties on the proper use, benefits, and maintenance of green building systems including a maintenance staff notification process for improperly functioning equipment.			☑	
	(11)	Information on the importance and operation of the building's fresh air ventilation system.			☑	
1002.3		**1002.3 Maintenance manual.** Maintenance manuals are created and distributed to the responsible parties in accordance with Section 1002.0. Between all of the maintenance manuals, five or more of the following options are included.	1	3	Build-to-Rent? ☐	
		(Points awarded per two items. Points awarded for non-mandatory items.)				
	(1)	A narrative detailing the importance of maintaining a green building. This narrative is included in all responsible parties' manuals.	Mandatory		☑	
	(2)	A list of local service providers that offer regularly scheduled service and maintenance contracts to ensure proper performance of equipment and the structure (e.g., HVAC, water-heating equipment, sealants, caulks, gutter and downspout system, shower and/or tub surrounds, irrigation system).			☑	
	(3)	User-friendly maintenance checklist that includes:			☑	
	(a)	HVAC filters				
	(b)	thermostat operation and programming				
	(c)	lighting controls				
	(d)	appliances and settings				
	(e)	water heater settings				
	(f)	fan controls				
	(4)	List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials.			☑	
	(5)	Information on organic pest control, fertilizers, deicers, and cleaning products.			☐	
	(6)	Instructions for maintaining gutters and downspouts and the importance of diverting water a minimum of 5 feet away from foundation.			☑	
	(7)	Instructions for inspecting the building for termite infestation.			☐	
	(8)	A procedure for rental tenant occupancy turnover that preserves the green features.			☑	
	(9)	An outline of a formal green building training program for maintenance staff.			☑	
	(10)	A green cleaning plan which includes guidance on sustainable cleaning products.			☑	
	(11)	A maintenance plan for active recreation and play spaces (e.g., playgrounds, ground markings, exercise equipment.			☐	
1002.4		**1002.4 Training of building owners.** Building owners are familiarized with the role of occupants in achieving green goals. On-site training is provided to the responsible party(ies) regarding equipment operation and maintenance, control systems, and occupant actions that will improve the environmental performance of the building. These include:	Mandatory 8	8	☑ Build-to-Rent? ☐	
	(1)	HVAC filters				
	(2)	thermostat operation and programming				
	(3)	lighting controls				
	(4)	appliances operation				
	(5)	water heater settings and hot water use				
	(6)	fan controls				
	(7)	recycling and composting practices				
	(8)	Whole-dwelling mechanical ventilation systems				
1002.5		**1002.5 Multifamily occupant manual.** An occupant manual is compiled and distributed in accordance with Section 1002.0. *[Points awarded for non-mandatory items.]*	1 per 2 items	2	Build-to-Rent? ☐	
	(1)	NGBS certificate	Mandatory		☑	
	(2)	List of green building features	Mandatory		☑	
	(3)	Operations manuals for all appliances and occupant operated equipment including lighting and ventilation controls, thermostats, etc.	Mandatory		☑	
	(4)	Information on recycling and composting programs			☑	
	(5)	Information on purchasing renewable energy from utility			☐	
	(6)	Information on energy efficient replacement lamps			☑	
	(7)	List of practices to save water and energy			☑	
	(8)	Local public transportation options			☑	
	(9)	Explanation of benefits of green cleaning			☑	
1002.6		**1002.6 Training of multifamily occupants.** Prepare a training outline, video or website that familiarizes occupants with their role in maintaining the green goals of the project. Include all equipment that the occupant(s) is expected to operate including but not limited.	1 per 2 items	0	Build-to-Rent? ☐	
	(1)	Lighting controls			☐	
	(2)	Ventilation controls			☐	
	(3)	Thermostat operation and programming			☐	
	(4)	Appliances operation			☐	
	(5)	Recycling and composting			☐	
	(6)	HVAC filters			☐	
	(7)	Water heater setting and hot water use			☐	
1003 PUBLIC EDUCATION						
1003.0		**1003.0 Intent.** Increase public awareness of the National Green Building Standard and projects constructed in accordance with National Green Building Standard to help increase demand for high-performance homes.				
1003.1		**1003.1 Public Education.** One or more of the following is implemented:	2 Max	0		
	(1)	**Signage.** Signs showing the project is designed and built in accordance with the National Green Building Standard are posted on the construction site.	1		☐	
	(2)	**Certification Plaques.** National Green Building Standard certification plaques with rating level attainted are placed in a conspicuous location near the utility area of the home or, in a conspicuous location near the main entrance of a multifamily building.	1		☐	
	(3)	**Education.** A URL for the National Green Building Standard is included on site signage, builder website (or property website for multifamily buildings), and marketing materials for homes certified under the National Green Building Standard.	1		☐	

1004 POST OCCUPANCY PERFORMANCE ASSESSMENT

1004.0		**1004.0 Intent.** A verification system for post occupancy assessment of the building is intended to be a management tool for the building owner to determine if energy or water usage have deviated from expected levels so that inspection and correction action can be taken.				
1004.1		**1004.1** A verification system plan is provided in the building owner's manual (Sections 1001 or 1002). The verification system provides methods for demonstrating continued energy and water savings that are determined from the building's initial year of occupancy of water and energy consumption as compared to annualized consumption at least every four years.				
	(1)	Verification plan is developed to monitor post-occupancy energy and water use and is provided in the building owner's manual.	**1**	0	☐	
	(2)	Verification system is installed in the building to monitor post-occupancy energy and water use.	**3**	0	☐	

1005 INNOVATIVE PRACTICES

1005.1		**1005.1 Appraisals.** One or more of the following is implemented:				
	(1)	Energy rating or projected usage data is posted in an appropriate location in the home, or public posting so that an appraiser can access the energy data for an energy efficiency property valuation.	**2**	0	☐	
	(2)	An Appraisal Institute Form 820.05 "Residential Green and Energy Addendum" or Form 821 "Commercial Green and energy Efficient Addendum" that consider NGBS, LEED, ENERGY STAR certifications and equivalent programs, is completed for the appraiser by a qualified professional or builder to use in performing the valuation of the property.	**2**	0	☐	
	(3)	NGBS certification information or one of the Appraisal Institute Forms cited in (2) above is uploaded to a multiple listing service (MLS) or equivalent database so that appraisers can access it to compare property valuations.	**2**	2	Home Innovation makes key certification details available, but MLS organizations need to take affirmative action to ensure data is received and made publicly available. Contact us for more details.	

END OF CHAPTER 10

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.

B. Related Sections:
1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade. (Refer to Civil Drawings)
2. Section 321313 "Concrete Paving" for concrete pavement and walks. (Refer to Civil Drawings)

1.2 DEFINITIONS

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

1.3 ACTION SUBMITTALS

A. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

B. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Form materials and form-release agents.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.

7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch , minimum.

C. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

2.2 STEEL REINFORCEMENT

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

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 , plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

C. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc.

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

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Blended Hydraulic Cement: ASTM C 595 Type 1.

B. Normal-Weight Aggregates: ASTM C 33,

1. Maximum Coarse-Aggregate Size: 1 ½" nominal..
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M

2.5 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Water: Potable.

C. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.7 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.8 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use 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.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.9 CONCRETE MIXTURES

A. Proportion normal-weight concrete mixture as specified on drawings.

2.10 FABRICATING REINFORCEMENT

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

2.11 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F , reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F , reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with fine-graded granular material, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch .

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch . Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have

begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated.

3.11 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 6 inches
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.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.12 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENTS

A. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch . Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match

before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
6. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.

6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. , but less than 25 cu. yd. , plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.

    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
    b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

    a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .
10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive

strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

11. 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: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
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.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

A. 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.

END OF SECTION 033000

SECTION 035400 – CAST UNDERLAYMENT AND SOUND ATTENUATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Liquid-applied gypsum-based floor underlayment.

B. Sound attenuation mats.

1.2 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry for wood joist framing.

B. Section 061000 - Rough Carpentry for wood decking.

C. Section 061753 - Shop-Fabricated Wood Trusses.

1.3 REFERENCE STANDARDS

A. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.

B. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete 2018.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's data sheets documenting physical characteristics and product limitations of underlayment materials. Include information on surface preparation, environmental limitations, and installation instructions.

B. Certificate: Certify that products meet or exceed specified requirements.

C. Certificate: Provide certificate of compliance from authority having jurisdiction indicating approval of lightweight insulating gypsum materials in the required fire rated assembly.

D. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

1.6 FIELD CONDITIONS

A. Do not install underlayment until floor penetrations and peripheral work are complete.

B. Maintain minimum ambient temperatures of 50 degrees F (10 degrees C) and maximum ambient conditions of 95 degrees F (35 degrees C) 24 hours before, during, and 72 hours after installation of underlayment.

C. During the curing process, ventilate spaces to remove excess moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Gypsum Underlayment:

1. Maxxon; Gyp-Crete 2000/Multifamily: www.maxxon.com/products/gyp-crete-2000-multifamily/

B. Sound Control Mats:

1. Maxxon; Acouti-Mat 1/8: www.maxxon/product/acousti-mat-1-8/.

2.2 MATERIALS

A. Cast Underlayments:

1. Comply with applicable code for combustibility or flame spread requirements.
2. Provide certificate of compliance from authority having jurisdiction indicating approval of underlayment materials in the required fire rated assembly.
3. Gypsum-Based Underlayment: Gypsum based mix, that when mixed with water in accordance with manufacturer's directions will produce self-leveling underlayment with the following properties:
   a. Compressive Strength: Minimum 2000 pounds per square inch (17.24 MPa) when tested in accordance with ASTM C472.
   b. Final Set Time: 1 to 2 hours, maximum.
   c. Thickness: 3/4 inch (19 mm) to maximum 3-1/2 inch (89 mm).
   d. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0 when tested in accordance with ASTM E84.
4. Aggregate: Dry, well graded, washed silica aggregate, approximately 1/8 inch (3 mm) in size and acceptable to underlayment manufacturer.
5. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to underlayment mix materials.
6. Primer: Manufacturer's recommended type.

7. Joint and Crack Filler: Latex based filler, as recommended by manufacturer.
8. Sound Control Mat: Flexible sheet material.
   a. Accessories: Primers, perimeter isolation strips, seam tape, and other products recommended by mat manufacturer for complete, effective installation.

2.3 UNDERLAYMENT MIXING

A. Site mix materials in accordance with manufacturer's instructions.

B. Add aggregate for areas where thickness will exceed 3/4 inch (19 mm). Mix underlayment and water for at least two minutes before adding aggregate, and continue mixing to assure that aggregate has been thoroughly coated.

C. Mix to self-leveling consistency without over-watering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Confirm subfloor is structurally sound, stable, and solid.

B. Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

A. Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.

B. Vacuum clean surfaces.

C. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

D. Prime substrate in accordance with manufacturer's instructions. Allow to dry.

E. Close floor openings.

3.3 INSTALLATION – SOUND ATTENUATION MAT

A. Install sound control mat in accordance with manufacturer's instructions.

B. Lay mat loosely over entire subfloor area.

C. Do not use mechanical fasteners.

D. Do not install where continuous exposure to moisture is a possibility.

E. Install perimeter isolation strips between mat and wall or floor protrusions to prevent leakage of underlayment.

F. Wood Decking Installation:

1. Use primer recommended by mat manufacturer.
2. Install only on plywood or OSB boards with tongue-and-edges.

3.4 INSTALLATION - UNDERLAYMENT

A. Application:

1. Use Install underlayment in accordance with manufacturer's instructions.
2. Pump or pour material onto substrate. Do not retemper or add water.
   a. Pump, move, and screed while the material is still highly flowable.
   b. Be careful not to create cold joints.
   c. Wear spiked shoes while working in the wet material to avoid leaving marks.
3. Place to indicated thickness, with top surface level to 1/8 inch in 10 ft (1:1000).
4. For final thickness over 1-1/2 inches (38 mm), place underlayment in layers. Allow initial layer to harden to the point where the material has lost its evaporative moisture. Immediately prime and begin application of the subsequent layer within 24 hours.
5. Place before partition installation.
6. Where additional aggregate has been used in the mix, add a top layer of neat mix (without aggregate), if needed to level and smooth the surface.
7. If a fine, feathered edge is desired, steel trowel the edge after initial set, but before it is completely hard.

B. Curing:

1. Once underlayment starts to set, prohibit foot traffic until final set has been reached.
2. Prevent drafts from occurring during the setting process and causing dusting on the surface of underlayment.
3. Air cure in accordance with manufacturer's instructions.
   a. After allowing a minimum of 3 hours for setting, use fans and crack windows open to ensure good air movement and air exchange.
   b. If high-humidity poor drying conditions are encountered, use mechanical desiccating ventilators in addition to fans.

C. Field Quality Control:

1. An independent testing agency will perform field inspection and testing, as specified in Section 01 40 00 - Quality Requirements.
2. Placed Material: Agency will inspect and test for compliance with specification requirements.

D. Protection:

1. Protect against direct sunlight, heat, and wind; prevent rapid drying to avoid shrinkage and cracking.
2. Do not permit traffic over unprotected floor underlayment surfaces.

END OF SECTION 035400

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Concrete face brick.
3. Clay face brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Ties and anchors.
8. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel shelf angles for supporting unit masonry.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
1. Concrete face brick.
2. Clay face brick, in the form of straps of five or more bricks.
3. Special brick shapes.

1.5 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. 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 according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. 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.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 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.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover 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/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) 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/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, 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 and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.3 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Insulated CMUs: Where indicated, units shall contain rigid, specially shaped, cellular thermal insulation units complying with ASTM C 578, Type I, designed for installing in cores of masonry units.

C. CMUs: ASTM C 90.

1. Density Classification: Normal weight.
2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

D. Concrete Face Brick: ASTM C 1634.

1. Density Classification: Normal weight.
2. Size (Actual Dimensions): 3-5/8 inches wide by 2-2/3 inches high by 7-5/8 inches long.

2.4 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.

B. Clay Face Brick: Facing brick complying with ASTM C 216.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
2. Grade: SW.
3. Type: FBX.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67.
5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-5/8" inches wide by 2-2/3 inches high by 7-5/8 inches long.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Color and Texture: Match Architect's samples.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, 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 shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C 1329/C 1329M.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

H. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

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 A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.187-inch diameter.
5. Wire Size for Veneer Ties: 0.187-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 feet, with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall 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 A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
2. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
4. Stainless-Steel Bars: ASTM A 276 or ASTM A 666, Type 304.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
2. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
3. Wire: Fabricate from 3/16-inch- diameter, hot-dip galvanized steel wire.

D. 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.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Tie Section: Triangular-shaped wire tie made from 0.187-inch-diameter, hot-dip galvanized steel wire.

F. 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 0.105-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. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry-veneer anchors specified.

5. Screw-Attached, Masonry-Veneer Anchors:

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

        1) Hohmann & Barnard, Inc.'s "Thermal Concrete 2-Seal Tie" for wood stud backup application.

        2) Hohmann & Barnard, Inc.'s "Thermal Concrete 2-Seal Tie" for concrete backup application.

2.8 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Brick Ledge Cap: Basis-of-design Product as manufactured by ATAS International. Provide basis of design product, or comparable product approved by Architect.

1. Provide with manufacturer's recommended fasteners.

E. Weep Holes/Vents: Polypropylene in conformance with ASTM D2240.

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

    a. Hohmann & Barnard Inc.'s QV - Quadro-Vent

    b. Approved Equal.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

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

    a. MaosonPro's ProNet DT

    b. Approved Equal.

2. Configuration: Provide one of the following:

    a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.9 MASONRY CLEANERS

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

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. MasonPro's Surekleen 600.

2.10 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. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. 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 C 270, Proportion 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 masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For exterior, above-grade, load-bearing and 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.
4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 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 according to ASTM C 143/C 143M.

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. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. 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 feet, 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 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, 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 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, 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 feet, 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.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

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 one-third 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. 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.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs 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 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. Set stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. of wall area spaced not to exceed 24 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

   a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
   b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
   b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.
   c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.

3. Header Bonding: Provide masonry unit headers extending not less than 3 inches into each wythe. Space headers not more than 12 inches clear horizontally and 16 inches clear vertically.
4. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed tie sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
5. 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.
6. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of insulation.

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.

3.8 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 parapet 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 wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 2 inches wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 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 using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. 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. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 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 lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. 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 (600 mm) o.c. unless otherwise indicated.

E. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.

F. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use open-head joints to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.13 REINFORCED UNIT MASONRY INSTALLATION

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/ACI 530.1/ASCE 6.

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/ACI 530.1/ASCE 6 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.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. 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 shall be done at Contractor's expense.

B. Refer to Structural Drawings for masonry testing requirements.

3.15 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 stone and non-masonry 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 cleaner applied according to manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.16 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. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Elevator safety beam.
6. Loose bearing and leveling plates for applications where they are not specified in other Sections.
7. Refer to the structural drawings for additional information regarding metal fabrications. Where discrepancies occur between the structural drawings and the specifications the architect shall be the sole arbiter of which shall apply.

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.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

1.2 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 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. 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. Steel framing and supports for countertops.
2. Steel framing and supports for mechanical and electrical equipment.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

1. Temperature Change: 120 deg F, ambient; 180 deg F , material surfaces.

2.2 METALS

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

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

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.

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

E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

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

G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Galvanized steel, ASTM A 653/A 653M, structural steel, Grade 33 , with G90 coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; hot-dip galvanized after fabrication.

I. Aluminum Plate and Sheet: ASTM B 209 , Alloy 6061-T6.

J. Aluminum Extrusions: ASTM B 221 , Alloy 6063-T6.

2.3 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.4 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.

2.5 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. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.6 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.

2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.7 LOOSE BEARING AND LEVELING PLATES

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

B. Galvanize plates.

2.8 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 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.9 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.

2.10 FINISHES, GENERAL

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.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

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 railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with zinc-rich primer is indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Other Items: SSPC-SP 3, "Power Tool Cleaning."

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.

2.12 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

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. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

B. Anchor supports for overhead doors and overhead grilles securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

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

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 05 51 33 – METAL LADDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Aluminum access ladders.
   2. Aluminum ship's ladders.
   3. Ladder fall arrest system.

1.2 RELATED SECTIONS

A. Section 055000 "Metal Fabrications" for fasteners and installation requirements used to attach ladders to structure.

B. Division 26 "Electrical" for electrical grounding of ladders.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Detail fabrication and erection of each ladder indicated. Include plans, elevations, sections, and details of metal fabrications and their connections.

B. Selection Samples: For each finish specified, two complete sets of color chips representing manufacturer's full range of available colors.

C. Provide reaction loads for each hanger and bracket.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions by field measurement before fabrication.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.

1.6 WARRANTY

A. Manufacturer has responsibility for an extended Corrective Period for work of this Section for a period of 5 years commencing on the date of substantial completion.

1.7 EXTRA MATERIALS

A. Furnish touchup kit for each type and color of paint finish provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: O'Keeffe's, Inc.; 100 N Hill Drive, Suite 12, Brisbane, CA 94005. Toll Free Tel: (888) 653-3333. Tel: (415) 824-4900. Fax: (415) 824-5900. Email: info@okeeffes.com. Web: http://www.okeeffes.com. Provide basis of design product, or comparable product approved by Architect.

2.2 FIXED ACCESS LADDERS

A. Provide Basis-of-Design Ladder product, or comparable product approved by Architect as follows:
1. Interior Roof Access Ladder: Standard Duty Channel Rail Ladder; Model 500.

2.3 ALUMINUM

A. Aluminum Sheet: Alloy 5005-H34 to comply with ASTM B209.

B. Aluminum Extrusions: Alloy 6063-T6 to comply with ASTM B221.

2.4 ALUMINUM FINISHES

A. Interior Ladders located in Service Areas: Mill finish; as extruded.

2.5 FABRICATION

A. Rungs: Not less than 1-1/4 inches (32 mm) in section and 18–3/8 inches (467mm) long, formed from tubular aluminum extrusions. Squared and deeply serrated on all sides.
1. Rungs shall withstand a 1,500 pound (454 kg) load without deformation or failure.

B. Channel Side Rails: Not less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide.

C. Heavy Duty Tubular Side Rails: Assembled from two interlocking aluminum extrusions no less than 1/8 inch (3 mm) wall thickness by 3 inches (76 mm) wide. Construction shall be self-locking stainless steel fasteners, full penetration TIG welds and clean, smooth and burr-free surfaces.

D. Walk-Through Rail and Roof Rail Extension: Not less than 3 feet 6 inches (1067 mm) above the landing and shall be fitted with deeply serrated, square, tubular grab rails.

E. Landing Platform: 1-1/2 inches (38 mm) or greater diameter, tubular aluminum guardrails and decks of serrated aluminum treads.

F. Ladder Safety Post: Retractable hand hold and tie off.

G. Rail and Harness Fall Arrest System: Supplied where required, in accordance with OSHA regulation 1910.27; permanently mounted to ladder rungs and complete with necessary components.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate anchorages. Furnish setting drawings, templates, and anchorage structural loads for fastener resistance.

B. Do not begin installation until supporting structure is complete and ladder installation will not interfere with supporting structure work.

C. C. If supporting structure is the responsibility of another installer, notify Architect of unsatisfactory supporting work before proceeding.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and in proper relationship with adjacent construction. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

3.3 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 055133

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Rooftop equipment bases and support curbs.
4. Wood blocking , cants, and nailers.
5. Wood furring.

B. Related Requirements:

1. Section 061063 "Exterior Rough Carpentry."
2. Section 06 13 00 "Heavy Timber Construction."
3. Section 061533 "Wood Patio Decking" for elevated decks, including support framing.
4. Section 061600 "Sheathing" for sheathing, subflooring, and underlayment.
5. Section 061753 "Shop-Fabricated Wood Trusses" for wood trusses made from dimension lumber.
6. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

F. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 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.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.5 QUALITY ASSURANCE

1.6 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, GENERAL

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. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.

3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:

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.
3. Timber: 19 percent.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
3. After treatment, redry boards to 19 percent maximum moisture content.

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.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.
4. .

2.3 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall 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 according to 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 shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings.

2.4 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions by Grade: Standard, Stud, or No. 3 grade.

1. Application: Interior partitions not indicated as load bearing.
2. Species:
   a. Southern pine or mixed southern pine; SPIB.
   b. Spruce-pine-fir; NLGA.
   c. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

B. Load-Bearing Partitions by Grade: No. 2 grade.

1. Application: Exterior walls and interior load-bearing partitions.

2. Species: As called out on drawings

C. Joists, Rafters, and Other Framing by Grade: Select Structural No. 2 grade.

1. Species: As called out on drawings

2.5 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Boise Cascade Company.
   b. Louisiana-Pacific Corporation.
   c. Weyerhaeuser Company.
2. Species: As called out on Drawings

C. Moisture Protection:

1. For western species (Douglas fir/hemlock), factory end and edge seal laminated veneer lumber with opaque moisture barrier.
2. For southern and eastern species (southern yellow pine, yellow poplar), factory seal laminated veneer lumber on face, edge, and ends.

D. Parallel-Strand Lumber: Structural composite lumber made from wood strand elements with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cudahy Lumber Company.
   b. Weyerhaeuser Company.
2. Species: As called out on drawings
3. Extreme Fiber Stress in Bending, Edgewise: 2900 psi for 12-inch nominal- depth members.
4. Modulus of Elasticity, Edgewise: 2,200,000 psi.

2.6 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species: the following species:

1. Species: As called out on drawings

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
3. Eastern softwoods; No. 2 Common grade; NeLMA.

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.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.7 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall 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.
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For redwood, use stainless steel or hot-dip galvanized-steel fasteners.

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, ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets:

1. Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. 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.

C. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Install sill sealer gasket/termite barrier in accordance with manufacturer's written instructions at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

G. Do not splice structural members between supports unless otherwise indicated.

H. 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.

I. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

J. 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.

K. 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.

L. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

M. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

N. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

O. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring horizontally at 24 inches o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

3.4 INSTALLATION OF WALL AND PARTITION FRAMING

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs**,** except that two studs may be used for interior non-load-bearing partitions.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

D. Provide diagonal bracing in walls, at locations indicated, at 45-degree angle, full-story height unless otherwise indicated. Use 1-by-4-inch nominal- size boards, let-in flush with faces of studs or metal wall bracing, let into studs in saw kerf.

3.5 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:

1. Where supported on wood members, by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches.

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches.

D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.

F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

J. Provide bridging of type indicated below, at intervals of 96 inches o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.6 INSTALLATION OF CEILING JOIST AND RAFTER FRAMING

A. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

1. At valleys, provide double-valley rafters of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against valley rafters.
2. At hips, provide hip rafter of size indicated or, if not indicated, of same thickness as regular rafters and 2 inches deeper. Bevel ends of jack rafters for full bearing against hip rafter.

B. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.7 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.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061053 – MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking, cants, and nailers.
3. Wood furring and grounds.
4. Plywood backing panels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of 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 MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. 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 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 items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to 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. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.

C. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.

C. Concealed Boards: percent maximum moisture content of any of the following species and grades:

1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
2. Eastern softwoods, No. 2 Common grade; NELMA.
3. Northern species, No. 2 Common grade; NLGA.
4. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where 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 of Type 304 stainless steel.

B. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954, length as recommended by screw manufacturer for material being fastened.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.7 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

B. 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.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. 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.

D. Do not splice structural members between supports unless otherwise indicated.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

3.2 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 061053

SECTION 06 16 00.16 - SHEATHING (ZIP SYSTEM)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Combination wall sheathing, water resistive barrier and air barrier.
2. Combination roof sheathing and roof underlayment.
3. Self-adhering flexible flashing.
4. Liquid-applied flashing membrane.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.

1.3 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. For panels with integral water resistive barrier, include data on air/-moisture-infiltration protection based on testing according to referencing standards.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Outdoor Storage. Comply with manufacturer's recommendations and as follows:

1. Set panel bundles on supports to keep off ground.
2. Cover panels loosely with waterproof protective material.
3. Anchor covers on top of stack but keep away from sides and bottom to assure adequate air circulation.
4. When high moisture conditions exist, cut banding on panel stack to prevent edge damage.

1.5 WARRANTY

A. Special Warranty: Manufacturer’s standard form in which manufacturer agrees to repair or replace components of sheathing system that fail due to manufacturing defects within specified warranty period.

1. Construction Period Warranty: Manufacturer shall warrant the panels and tape for weather exposure for a period of 180 days from installation.
2. System Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WOOD PANEL PRODUCTS

A. Oriented Strand Board: DOC PS 2-10.

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated. Thickness shall satisfy minimum and maximum requirements for referenced performance category.

C. Factory mark panels to indicate compliance with applicable standard.

2.3 COMBINATION WALL SHEATHING, AIR AND WATER-RESISTIVE BARRIER

A. Oriented-Strand-Board Wall Sheathing: With integral water-resistive barrier, Exposure 1 sheathing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; ZIP System Wall Sheathing. Provide basis of design product, or comparable product approved by Architect.
2. Span Rating, Panel Grade and Performance Category: Not less than 24/16; Rated Sheathing 7/16 Performance Category.
3. Edge Profile: Square edge.
4. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on centers spacing.
5. Performance Standard: DOC PS2-10 and ICC-ES ESR-1474.
6. Factory laminated integral water-resistive barrier facer.
7. Perm Rating of Integral Water-Resistive Barrier: 12-16 perms.
8. Assembly maximum air leakage of 0.0072 cfm/sq. ft. (0.037 L/s x sq. m) infiltration and 0.0023 cfm/ sq. ft. (0.012 L/s x sq. m) exfiltration at a pressure differential of 1.57 (psf 75 Pa).
9. Exposure Time: Designed to resist weather exposure for 180 days.

2.4 COMBINATION ROOF SHEATHING AND ROOF UNDERLAYMENT

A. Oriented-Strand-Board Roof Sheathing: With integral water-resistive barrier, Exposure 1 sheathing.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods LLC; ZIP System® Roof and Wall Sheathing. Provide basis of design product, or comparable product approved by Architect.
2. Span Rating, Panel Grade and Performance Category: Not less than 40/20; Structural 1; 5/8 Performance Category.
3. Edge Profile: Tongue and groove.
4. Provide fastening guide on top panel surface with pre-spaced fastening symbols for 16-inches (406 mm) and 24-inches (610 mm) on center spacing.
5. Performance Standard: DOC PS2-10 and ICC-ES ESR-1473.
6. Factory laminated integral roofing underlayment facer.
7. Exposure Time: Designed to resist weather exposure for 180 days.

B. Panel Edge Clips: Provide panel edge clips approved for application in accordance with code approvals and panel manufacturer’s written instructions.

2.5 FASTENERS

A. General: Provide fasteners of size and type that comply with requirements specified in this article by the authority having jurisdiction, International Building Code, International Residential Code, Wood Frame Construction manual, and National Design Specification.

2.6 MISCELLANEOUS MATERIALS

A. Self-Adhering Seam and Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, proprietary seam tape consisting of polyolefin film with acrylic adhesive.

1. Basis-of-Design Product: Subject to compliance with requirements provide Huber Engineered Woods; ZIP System® Seam and Flashing Tape. Provide basis of design product, or comparable product approved by Architect.
2. Thickness: 0.012 inch (0.3 mm).
3. Width: [3.75 inch (95.3 mm)] [6 inch (152.4 mm)].
4. Code Compliance: Comply with requirements of authorities having jurisdiction and ICC Evaluation Service, Inc. "AC148 - Acceptance Criteria for Flexible Flashing Materials."
5. International Code Council (ICC), ICC-ES ESR2227.
6. American Architectural Manufacturer’s Association; AAMA 711.

B. Liquid-Applied Flashing Membrane: Gun-grade, cold-applied, silyl-terminated polyether (STPE) liquid flashing membrane compatible with sheathing/weather barrier and self-adhering seam and flashing tape and tested as part of an assembly meeting performance requirements. Follow manufacturer's recommendation for integration with self-adhering seam and flashing tape.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Huber Engineered Woods; ZIP System® Liquid Flash. Provide basis of design product, or comparable product approved by Architect.
2. Hardness, Shore A, ASTM C 661: 40 to 45.
3. Total Solids: 99 percent.

4. Tensile Strength, ASTM D 412: 75 psi (517 kPa).

C. Self-Adhering Flexible Flashing Tape: Pressure-sensitive, self-adhering, cold-applied, flexible flashing tape consisting of a flexible acrylic foam backing with acrylic adhesive.

1. Basis-of-Design Product: Subject to compliance with requirements provide Huber Engineered Woods; ZIP System® Stretch Tape. Provide basis of design product, or comparable product approved by Architect.
2. Thickness: 0.042 inch (1.067 mm).
3. Width: 6 inch (150 mm) and 10 inch (254 mm).
4. Code Compliance: Comply with requirements of authorities having jurisdiction and ICC Evaluation Service, Inc. "AC148 - Acceptance Criteria for Flexible Flashing Materials."
5. International Association of Plumbing and Mechanical Officials (IAPMO), IAPMO ER365.
6. American Architectural Manufacturer's Association; AAMA 711.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Chapter 23 in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate wall, parapet, and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

3.2 WOOD STRUCTURAL PANEL INSTALLATION

A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

B. Fastening Methods: Fasten panels as indicated below:

1. Wall and Roof Sheathing:

    a. Nail or staple to wood framing.
    b. Screw to cold-formed metal framing.
    c. Space panels 1/8 inch (3 mm) apart at edges and ends.
    d. Install fasteners 3/8 inch (9.5 mm) to 1/2 inch (12.7 mm) from panel edges.
    e. Space fasteners in compliance with requirements of authority having jurisdiction.

3.3 SHEATHING JOINT TREATMENT

A. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply seam tape to joints between sheathing panels.
2. Utilize tape gun or hard rubber roller provided by manufacturer to ensure tape is completely adhered to substrates.
3. When using liquid-applied flashing to seal sheathing joints follow manufacturer's recommendations for sealing panel seams.

3.4 FLEXIBLE OR LIQUID-APPLIED FLASHING INSTALLATION

A. Apply tape flexible flashing or membrane where indicated to comply with manufacturer's written instructions.

1. After flexible flashing tape has been applied, roll surfaces with a hard rubber to ensure that flashing is completely adhered to substrates.
2. Width for flexible flashing: 6 inch (154.4 mm).
3. Apply liquid-applied flashing membrane at penetrations, gaps, and cracks to form continuous weathertight surface. Apply liquid membrane according to manufacturer's written instructions. Follow manufacturer's recommendation for integration with seam and flashing tape.

B. Apply liquid applied flashing membrane where indicated to comply with manufacturer's written instructions.

1. After liquid applied flashing membrane has been applied, tool wet product with a plastic spreader, putty knife, or similar tool to ensure that flashing is opaque, and substrate is no longer visible.
2. Minimum Thickness for Liquid Flashing: 12 mils (0.3 mm).
3. Apply liquid flashing membrane according to manufacturer's written instructions. Follow manufacturer's recommendations for integration with seam and flashing tape or flexible flashing tape.

C. Apply flexible flashing tape where indicated to comply with manufacturer's written instructions.

1. After flexible flashing tape has been applied, roll surfaces with a hard rubber to ensure that flashing is completely adhered to substrates.
2. Width of flexible flashing: 6 inches (154.4 mm) or 10 inches (254 mm).

END OF SECTION 061600.16

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood roof trusses.
2. Wood girder trusses.

1.2 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification from 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 from treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to truss fabricator.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer professional engineer and fabricator.

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss-fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:

1. Metal-plate connectors.

1.5 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program, complies with quality-control procedures in TPI 1, and involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction and is certified for chain of custody by an FSC-accredited certification body.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off of ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design metal-plate-connected wood trusses.

B. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

C. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (ALSC) Board of Review. Provide lumber graded 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. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with 15 percent maximum moisture content at time of dressing.

B. Minimum Chord Size for Roof Trusses: As determined by delegated design engineer.

C. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 061000 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Fabricate connector plates to comply with TPI 1.

B. Hot-Dip Galvanized-Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation; and not less than 0.036 inch thick.

1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.

2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

2.5 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 92 percent zinc dust by weight.

2.6 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly, with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry."
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not comply with requirements.

1. Damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND 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.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces according to ASTM A780/A780M and manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections to verify that temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

END OF SECTION 061753

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior trim, including non-fire-rated interior door frames.
2. Shelving.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
2. Section 099123 "Interior Painting" for priming and backpriming of interior finish carpentry.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors 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. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.

1. Protect materials from weather by covering with waterproof sheeting, securely anchored.
2. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet-work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with applicable rules of any rules-writing agency certified by the American Lumber Standard Committee's (ALSC) Board of Review. Grade lumber by an agency certified by the ALSC's 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. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by grading agency.

B. Softwood Plywood: DOC PS 1.

C. Hardboard: ANSI A135.4.

D. MDF: ANSI A208.2, Grade 130 .

E. Particleboard: ANSI A208.1, Grade M-2.

F. Melamine-Faced Particleboard: Particleboard complying with ANSI A208.1, Grade M-2, finished on both faces with thermally fused, melamine-impregnated decorative paper and complying with NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

1. Color: White .

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC1 .

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the ALSC's Board of Review.
   a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
   a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
7. Application: Where indicated on Drawings.

2.3 INTERIOR TRIM

A. Hardwood Lumber Trim for Transparent Finish (Stain or Clear Finish):

1. Species and Grade: As indicated; NHLA A Finish.
2. Maximum Moisture Content: 10 percent.
3. Finger Jointing: Not allowed.
4. Gluing for Width: Not allowed.
5. Veneered Material: Not allowed.
6. Face Surface: Surfaced (smooth).
7. Matching: Selected for compatible grain and color.

B. Moldings for Opaque Finish (Painted Finish): Made to patterns included in MMPA's "WM/Series Softwood Moulding Patterns."

1. Softwood Moldings: MMPA WM 4, P grade.
   a. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
   b. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
2. Casing Pattern: WM 376, 11/16-by-2-1/4-inch beaded-edge casing.

2.4 SHELVING AND CLOTHES RODS

A. Utility Shelving: Made from the following material, 3/4 inch thick:

1. Melamine-faced particleboard with applied-PVC front edge.

B. Closet Shelving: Ventilated wire shelf made from the following material, Grade C-1008 bright, basic, cold-drawn steel wire with average tensile strength of 100,000 psi with continuous 3-5mil epoxy-polyester hybrid powder coating in a hard, smooth, durable finish:

1. Coat Closets: 12-inch depth with integral free slide hanger rod
   a. Color: White
2. Linen Closets: 9-inch or 12-inch to suite closet depth
   a. Color: White

C. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.

D. Fixed Shelf Mounting Brackets: Manufacturers standard for shelf type.

2.5 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

B. Glue: Aliphatic-resin, polyurethane, or resorcinol wood glue recommended by manufacturer for general carpentry use.

1. Verify adhesives have a VOC content of 30 g/L or less.

C. Paneling Adhesive: Comply with paneling manufacturer's written instructions for adhesives.

D. Multipurpose Construction Adhesive: Formulation, complying with ASTM D3498, that is recommended for indicated use by adhesive manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.

2.6 FABRICATION

A. Back out or kerf backs of the following members, except those with ends exposed in finished work:

1. Interior standing and running trim, except shoe and crown molds.
2. Wood-board paneling.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials.

1. Use concealed shims where necessary for alignment.
2. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
3. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
4. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
5. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 INSTALLATION OF STANDING AND RUNNING TRIM

A. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available.

1. Do not use pieces less than 24 inches long, except where necessary.
2. Stagger joints in adjacent and related standing and running trim.
3. Cope Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint.
4. Use scarf joints for end-to-end joints.
5. Plane backs of casings to provide uniform thickness across joints where necessary for alignment.
6. Match color and grain pattern of trim for transparent finish (stain or clear finish) across joints.
7. Install trim after gypsum-board joint finishing operations are completed.
8. Install without splitting; drill pilot holes before fastening where necessary to prevent splitting.
9. Fasten to prevent movement or warping.
10. Countersink fastener heads on exposed carpentry work and fill holes.

3.5 INSTALLATION OF SHELVING AND CLOTHES RODS

A. Cut shelf cleats at ends of shelves about 1/2 inch less than width of shelves and sand exposed ends smooth.

1. Install shelf cleats by fastening to framing or backing with finish nails or trim screws, set below face and filled.
2. Space fasteners not more than 16 inches o.c. Use two fasteners at each framing member or fastener location for cleats 4 inches nominal in width and wider.
3. Apply a bead of multipurpose construction adhesive to back of shelf cleats before installing.
4. Remove adhesive that is squeezed out after fastening shelf cleats in place.

B. Install shelf brackets according to manufacturer's written instructions, spaced not more than 32 inches o.c. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

C. Install standards for adjustable shelf supports according to manufacturer's written instructions. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors. Space fasteners not more than 12 inches o.c.

D. Install standards for adjustable shelf brackets according to manufacturer's written instructions, spaced not more than 36 inches o.c. and within 6 inches of ends of shelves. Fasten to framing members, blocking, or metal backing, or use toggle bolts or hollow wall anchors.

E. Cut shelves to neatly fit openings with only enough gap to allow shelves to be removed and reinstalled.

1. Install shelves, fully seated on cleats, brackets, and supports.
2. Fasten shelves to cleats with finish nails or trim screws, set flush.
3. Fasten shelves to brackets to comply with bracket manufacturer's written instructions.

3.6 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements.

1. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

B. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces.

B. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 066500 – SIMULATED WOOD TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. PVC trim boards.
2. PVC wall panels.
3. Column Wraps.

B. Related Requirements:

1. Section 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal flashing used with balcony decking.

2. Section 09 91 13 “Exterior Painting” for painting and coating.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacture’s data sheets on each product to be used.

B. Samples: For each product specified, two samples, minimum size 6 inches long, representing actual product, color, finish.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Installer with a minimum of 3 years experience with the installation of PVC trim products.

B. Regulatory Requirements: Check with Local Building Code for installation requirements.

C. Allowable Tolerances:

1. Variation in component length: -0.00 / +1.00”
2. Variation in component width: ± 1/16”
3. Variation in component thickness: ± 1/16”
4. Variation in component edge cut: ± 2°
5. Variation in Density -0% + 10%

1.4 DELIVERY, STORAGE, AND HANDLING

A. Trim materials should be stored on a flat and level surface on a full shipping pallet. Handle materials to prevent damage to product edges and corners.

B. Store materials under a protective covering to prevent jobsite dirt and residue from collecting on the boards.

1.5 WARRANTY

A. Provide manufacturer's Limited Lifetime warranty against defects in manufacturing that cause the products to rot, corrode, delaminate, or excessively swell from moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: AZEK® PaintPro® Trimboards manufactured by The AZEK® Company, which is located at: 888 N Keyser Ave Scranton, PA 18508. Provide basis of design product, or comparable product approved by Architect.

2.2 MATERIALS

A. PVC: Free foam cellular PVC material with a small cell microstructure and density of .55 grams/cm³.

B. Performance and physical characteristic requirements:

1. Physical:
   a. Density: .55 g/cm³; ASTM Method D792.
   b. Water Absorption: .15%; ASTM Method D570.

2. Mechanical:
   a. Tensile Strength: 2,256 psi; ASTM Method D638
   b. Tensile Modulus: 144,000 psi; ASTM Method D638
   c. Flexural Strength: 3,329 psi; ASTM Method D790.
   d. Flexural Modulus: 144,219 psi; ASTM Method D790.
   e. Nail Hold: 35 Lbf/in of penetration; ASTM Method D1761
   f. Screw Hold: 680 lbf/in of penetration; ASTM Method D1761.
   g. Staple Hold: 180Lbf/in of penetration; ASTM Method D1761.
   h. Gardner Impact: 103 in-lbs; ASTM Method D5420.
   i. Charpy Impact (At 23°C): 4.5 ft-lbs; ASTM Method D256

3. Thermal:
   a. Coefficient of Linear Expansion: 3.2 x 10-5 in/in/°F; ASTM Method D696.
   b. Burning Rate: No burn when flame removed; ASTM Method D635.
   c. Flame Spread Index: 25; ASTM Method E84.
   d. Heat Deflection Temp 264 psi: 150°F; ASTM Method D648.
   e. Oil Canning (At140°F): Passed ASTM Method D648.

2.3 SIMULATED WOOD TRIM

A. PVC Trimboard: Basis-of-Design; AZEK® Trimboard with Sealed Edge, designed with a natural appearance to compliment fiber cement and natural cedar.

1. Size:
   a. Nominal Width: As indicated on drawings.
   b. Nominal Thickness: As indicated on drawings.
   c. Length: 16-feet.

2. Finish:
   a. Reversible with Traditional Smooth finish.

B. Sheet Board: Basis-of-Design; AZEK® Traditional Smooth finish Sheet. For use as sheet materials or to create columns and gingerbread millwork.

1. Size; as indicated on drawings, from available sheet sizes:
   a. Standard Sheet Sizes; Width by Length:
      1) 4 foot by 8 foot
      2) 4 foot by 10 foot
      3) 4 foot by 12 foot
      4) 4 foot by 18 foot
      5) 4 foot by 20 foot
   b. Standard Sheet Thickness:
      1) 3/8 inch
      2) 1/2 inch
      3) 5/8 inch
      4) 3/4 inch
      5) 1 inch
      6) 1-1/4 inch
      7) 1-1/2 inch
2. Finish:
   a. Smooth finish.

C. PVC Columnwrap: Basis-of-Design; AZEK® one-piece column wraps.
1. Size; as indicated on drawings, from available sheet sizes:
   a. Nominal Width:
      1) 4 inches by 4 inches (inside dimensions 3-3/4 inches)
      2) 6 inches by 6 inches (inside dimensions 5-3/4 inches)
      3) 8 inches by 8 inches (inside dimensions 7-1/2 inches)
   b. Length:
      1) 8 feet 6 inches
      2) 10 feet
   c. Thickness: 1/2 inch.
   d. Finish: Traditional/Smooth finish.

2.4 ACCESSORIES

A. Fasteners: Use manufacturer recommended concealed trim screw with matching paintable PVC plug. Do not use staples, small brads, and wire nails.

B. Adhesives: Use manufacturer recommended cellular PVC cement, to prevent joint separation. To bond PVC trim to other substrates, various adhesives may be used. Consult adhesive manufacturer to determine suitability.

C. Sealants: Use urethane, polyurethane or acrylic based sealants without silicone.

2.5 FINISHES

A. Preparation:
1. Follow manufacturer's instructions for surface preparation prior to painting.
2. Surface must be clean and dry.
3. Use a 100% acrylic latex paint with a Light Reflective Value (LRV) of 55 or higher.
4. Follow the paint manufacturer’s recommendations to apply.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with manufacturer’s product catalog installation instructions and product technical bulletin instructions.

B. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Cut PVC trim products using carbide tipped blades designed to cut lumber. Do not use fine tooth metal cutting blades. Excessive friction, poor board support, or worn or improper tooling will result in rough edges.

B. Drill PVC trim with same tools to drill hardwood lumber; avoid frictional heat build-up.

C. Mill PVC trim products using standard milling machines used to mill lumber, with a relief angle of 20-degrees to 30-degrees. Optimize cutting spead with the number of knives and feed rate.

D. Route PVC trim with standard carbide tipped router bits designed for use in routing lumber.

E. Finish edges by sanding, grinding or filing with traditional woodworking tools.

F. Securely attach exterior rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. ICC-ES AC70 for power-driven fasteners.
2. "Fastening Schedule" in ICC's International Building Code.
3. Use 2 fasteners per every framing member for trim board applications. Trim boards 12” or wider, as well as sheets, will require additional fasteners.
4. Install fasteners no more than 2” from the end of each board.

5. Pre-drill trim if large fasteners are used or product is installed in low temperatures.
6. Glue joints between pieces to eliminate joint separation. Secure glue joints with a fastener and/or fastened on each side of the joint to allow adequate bonding time. Surfaces to be glued should be smooth, clean and in complete contact with each other.
7. Allow 1/8-inch-per-18-feet of material for thermal expansion and contraction. When joints between pieces are glued to eliminate joint separations, allow expansion and contraction at ends of run.

G. Apply paint, when scheduled, within 180 days of UV exposure. For lighter colors with a Light Reflective Value (LRV) 55 or greater; paint must be 100% acrylic latex. For darker colors with an LRV less than 55; Paint must be vinyl-safe from a vinyl-safe color palette. Custom color shall use a coating with solar reflective pigments.

END OF SECTION 066500

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes
   1. Pre-applied waterproofing for vertical and horizontal applications prior to cast-in-place concrete installation.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 01 33 00 Submittal Procedures.

B. Action submittals
   1. Product data
      a. Standard details
      b. Technical data sheets
   2. Site quality control submittals
      a. Waterproofing Manufacturer Authorized Inspector reports and digital photographs.

1.3 QUALITY ASSURANCE

A. Qualifications
   1. Manufacturer qualifications
      a. Minimum of 20 years of experience in the production and sales of waterproofing.
   2. Installer qualifications
      a. Authorized by Waterproofing Manufacturer to complete Work as specified.
      b. 3 years minimum of experience in Work as described in this section.
   3. Licensed professionals
      a. Inspector authorized by Waterproofing Manufacturer to complete waterproofing inspections as specified.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements
   1. Deliver materials in original, factory-sealed, unopened containers with intact and legible product label and manufacturer name.

B. Storage and Handling
   1. Store materials as recommended by the Manufacturer in a protected area and out of direct sunlight. Protect materials from rain and physical damage.

1.5 SITE CONDITIONS

A. Ambient Conditions
   1. Do not perform Work during rain or inclement weather.
   2. Refer to Waterproofing Manufacturer's product specific published literature.

1.6 **WARRANTY**

A. Manufacturer's warranty:
1. Material warranty:
a. Warrants product against product defect. Provides material only for a period of 5 years from date of purchase.
2. Workmanship warranty:
a. Warrant the system and installation. Provide material and labor costs for repair for a period of 5 years from the date of installation completion as a result of any of the following:
1. Manufacturing product defect
2. Faulty workmanship

PART 2 - PRODUCTS

2.1 **ASSEMBLIES**

A. Basis-of-Design Product: Provide Basis-of-Design product, or comparable product approved by Architect.
1. Henry® a Carlisle Company, 336 Cold Stream Rd., Kimberton, PA 19442; (800) 486-1278, www.henry.com

B. Performance Criteria
1. Resistance to hydrostatic head (ASTM D5385): 231 ft. (70.4m)
2. Water absorption (ASTM D570): 0.4%
3. Lateral migration resistance (ASTM D5385 Modified): 231 ft. (70.4m)
4. Puncture resistance (ASTM E154): 110 lbs (490 N)
5. Lap peel adhesion (ASTM D1876): 6.9lbs/in (1200 N/m)
6. Permeance (ASTM E96): <0.01 Perms
7. Peel adhesion to concrete (ASTM D903): 5 lbs/in (875 N/m)

C. Materials
1. Pre-applied sheet waterproofing
a. Pre-applied, fully and permanently bonded polypropylene membrane laminated to a chemically enhanced non-woven geotextile fleece with a dimpled surface and adhesive to provide mechanical attachment to wet concrete that forms a permanent barrier seal, having the following typical properties:
1. Basis-of-design: Blueskin PreSeal® 320
2. Resistance to hydrostatic head (ASTM D5385): 231 ft. (70.4m)
3. Water absorption (ASTM D570): 0.4%
4. Lateral migration resistance (ASTM D5385 Modified): 231 ft. (70.4m)
5. Puncture resistance (ASTM E154): 110 lbs (490 N)
6. Lap peel adhesion (ASTM D1876): 6.9lbs/in (1200 N/m)
7. Permeance (ASTM E96): <0.01 Perms
8. Peel adhesion to concrete (ASTM D903): 5 lbs/in (875 N/m)
2. Drainage composite:
a. Two-part prefabricated geo-composite drain board consisting of a formed polystyrene core covered on one side with a woven or non-woven polypropylene filter fabric:
1. Basis-of-design: MiraDRAIN®

3. Sealant:
    a. Moisture cure, STPE polymer-based sealant:
        1. Basis-of-design Product: Henry 925 BES Sealant
    b. One-component polyurethane swellable sealant:
        1. Basis-of-design: MiraSTOP™ SS
4. Tape:
    a. Double-sided, acrylic adhesive tape:
        1. Basis-of-Design: Blueskin PreSeal Tape 50S
    b. Reinforced acrylic detailing tape:
        1. Basis-of-Design: Blueskin PreSeal Tape 120V
5. Tie-back cover:
    a. Pre-formed, high-impact resistant, heavy-duty thermoplastic cover designed to protect the waterproofing membrane integrity at soil retention tie-back systems:
        1. Basis-of-Design: Henry Tie-Back Cover

2.2 ACCESSORIES

A. Waterstops
1. Swelling waterstop:
    a. Self-adhering, expandable bentonite clay waterstop:
        1. Basis-of-Design: MiraSTOP® BW
    b. Self-adhering, non-bentonite waterstop:
        1. Basis-of-Design: MiraSTOP NBW
2. Non-swelling waterstop:
    a. Non-swelling preformed joint sealant:
        1. Basis-of-Design: Synko-Flex® Waterstop
3. Injection hose waterstop
    a. Injection hose waterstop:
        1. Basis-of-Design: MiraSTOP IW

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions
1. Verify substrates are in accordance with Waterproofing Manufacturer requirements and as specified in this Section prior to waterproofing installation. Commencement of the Work indicates installer acceptance of the substrate.
    a. Verify substrates are sound, solid, continuous, regular, and smooth and free of loose aggregate and sharp protrusions.
    b. Verify shuttering/formwork is clean and free of frost, oil, grease, dirt, excess mortar, release agents or other contaminants.
    c. Verify surfaces are not covered in standing water. Remove standing water prior to waterproofing installation.
    d. Installations over compacted earth or crushed stone:
        1. Verify gravel subbase aggregate is 3/4-inch (20 millimeters) or smaller.
        2. Verify compacted earth or crushed stone is fully compacted to avoid displacement due to traffic or concrete pour.
    e. Verify pre-applied waterproofing is suitable for application onto sheet piling where applicable. Prepare surface as required.

f. Verify areas of anticipated swellable waterstop has a minimum of 3 inches (75 millimeters) of concrete cover.

3.2 PREPARATION

A. Protection of In-Place Conditions
1. Protect areas and surfaces not included in scope of Work against damage or soiling.

B. Surface Preparation
1. Vertical applications requiring substrate preparation over sheet piling:
   a. Prepare vertical substrates with plywood, insulation, or drainboard to create a continuous surface. Install drain board with fabric side facing soil retention system.
2. Fill gaps or voids that exceed 0.5-inch (10 millimeter) wide gap maximum with Waterproofing Manufacturer approved material.
3. Grout around penetrations for stability.

3.3 INSTALLATION

A. Detailing and flashing
1. Install detailing and flashings per Waterproofing Manufacturer's details.

B. Waterproofing
1. Install waterproofing membrane with polypropylene film side facing existing substrate and dimpled surface geotextile side facing the installer.
2. Verify waterproofing is clean, dry, and free from contaminants prior to subsequent membrane installations.
   a. Clean waterproofing membrane as required in accordance with product specific technical data sheet.
3. Overlap subsequent membrane seams 2 inches (50 millimeters).
4. Side laps:
   a. Remove plastic release liner at factory applied adhesive and firmly press overlapping membrane into place to adhere membrane seams.
   b. Seal membrane seams in accordance with Waterproofing Manufacturer's details.
5. End laps:
   a. Stagger end laps and seal membrane seams in accordance with Waterproofing Manufacturer's details.
6. Roll seams with heavy roller.
7. Verify waterproofing seams are continuous and secure with no voids or gaps.
8. Vertical substrates:
   a. Secure waterproofing membrane as required with one of the following methods:
      1. Tape:
         a. Secure membrane with double sided tape.
      2. Mechanical attachment:
         a. Secure membrane with small, low profile, non-rusting, substrate appropriate fasteners to create a smooth and flat membrane seam.
         b. Seal fasteners in accordance with Waterproofing Manufacturer's details.
9. Horizontal substrates:

a. Extend pre-applied waterproofing 24 inches (600 millimeters) beyond base slab to create a trafficable space and minimize membrane soiling or damage.

C. Waterstop
1. Install waterstop in accordance with Waterproofing Manufacturer requirements.
2. Refer to product specific published literature for installation instructions.

3.4 SITE QUALITY CONTROL

A. Site Tests and Inspections
1. Refer to Waterproofing Manufacturer for warranty requirements.
2. Waterproofing Manufacturer's Authorized Inspector reports:
   a. Produce reports and digital photographs documenting each inspection. Failure to provide Waterproofing Manufacturer's Authorized Inspector inspection reports will result in delay or rejection of warranty eligibility.
3. Inspect waterproofing at periodic intervals during installation and during the following phases:
   a. Substrate preparation completion
   b. After steel placement, before concrete is installed
   c. Periodic intervals during concrete placement or backfill per project specific requirements
   d. After Work by other trades that may compromise the integrity of the waterproofing

3.5 CLEANING

A. Waste Management
1. As the Work proceeds, and upon completion, promptly clean up and remove from the premises all rubbish and surplus materials resulting from the foregoing Work.
2. Clean soiled surfaces, spatters, and damage caused by Work of this Section.
3. Dispose of waterproofing per local code ordinances.

3.6 PROTECTION

A. Protect waterproofing from damage by other trades.

B. Create designated walkway areas to limit traffic on installed waterproofing.

END OF SECTION 071326

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Related Requirements:

1. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing for insulation specified as part of roofing construction.
2. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Extruded polystyrene foam-plastic board insulation.
2. Glass-fiber blanket insulation.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For insulation, indicating compliance with requirements for low-emitting materials.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type VI Under Slab Insulation ASTM C578, Type VI, 40-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Chemical Company (The).
   b. DuPont de Nemours, Inc.
   c. Kingspan Insulation Limited.
   d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. CertainTeed LLC; Saint-Gobain North America.
   b. Knauf Insulation.
   c. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 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.

PART 3 - EXECUTION

3.1 PREPARATION

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

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
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.
6. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
   a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

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. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 074646 - FIBER CEMENT VERTICAL PANEL SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Fiber cement vertical panel system set in a rain screen application.
2. Integral trim, flashings, and accessories.

B. Related Sections:
1. Section 076200 “Sheet Metal Flashing and Trim”, for flashing and trim.
2. Section 079200 “Joint Sealers” for joint sealers and accessories.
3. Section 099123 “Exterior Painting” for field-applied paint finish for touch-ups.

1.2 SYSTEM DESCRIPTION

A. Design Requirements: Design and install panel system to withstand minimum wind pressures indicated on the structural drawings.

B. Sole Source Responsibility: Installer in conjunction with the Manufacturer shall be responsible for providing materials from a company or companies that will honor the installation and warranty provisions described herein; but not less than any warranty available from said manufacture(s).

1.3 SUBMITTALS

A. Submittals for Review:
1. Product Data: Indicate panel profiles, sizes, fastening methods, surface texture, and finish.
2. Samples:
a. 4 x 6 inch (100 x 150 mm) panel samples.
b. 3 inch (75 mm) long trim samples.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Minimum 2 years documented experience in work of this Section.

B. Mockup:
1. Size: Minimum 6 x 10 feet (1200 x 2400 mm).
2. Show: Moisture barrier, furring, panels, trim, flashings, and joint sealers. Include one horizontal flashing detail, one window jamb and head, one transition to masonry.
3. Show: Ventilation top and bottom per manufacturer’s installation instructions.
4. Locate where directed.
5. Mock must be approved by Manufacturer’s Representative before installation may continue.
6. Approved mockup may remain as part of the Work.

1.5 WARRANTIES

A. Warranty period: Provide manufacturer's non-pro-rated 30 year warranty providing coverage against hail and termite damage and defects in materials and workmanship.

B. Provide manufacturer's 15 year warranty providing coverage against peeling, cracking, and chipping of factory finished panels.

C. Provide installer's 2 year warranty providing coverage against defects in installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following manufacturer's:
   1. Basis of Design: James Hardie's Hardie Reveal Panel HZ5. (www.jameshardiecommercial.com) along with fiber cement batten joint cover components.

B. Substitutions per section 012500. As approved by the architect, in writing, prior to bid date. No exceptions.

2.2 MATERIALS

A. Provide all materials required for a complete installation in accordance with the manufacturer's instructions.

B. Fiber Cement Vertical Panel System:
   1. Source: Hardie Reveal Panel HZ5.
   2. Meet ASTM C1186, Grade A, Type II.
   3. Formulated from Portland cement, ground sand, cellulose fibers, additives, and water; formed under pressure to required profile.
   4. Sizes:
      48 by 96 inches
      48 by 108 inches
      48 by 120 inches
   5. Thickness: 5/16 inch .
   6. Surface texture: Smooth.
   7. Fire hazard classification: Maximum flame spread/smoke developed rating of 0/5, tested to ASTM E84.
   8. Combustibility; Noncombustible, tested to ASTM E136.
   9. Finish: ColorPlus factory-applied (100% acrylic latex), baked on finish, colors to be selected from manufacturer's full color range.

C. Fiber Cement Trim:
   1. HardieTrim HZ5 boards and HardieTrim HZ boards as manufactured by James Hardie Building Products, Inc.
   2. Finish: ColorPlus factory-applied (100% acrylic latex), baked on finish, match color of panels.

D. Provide all trims and furring required for a complete installation in accordance with the manufacturer's instructions and drawings.

2.3 ACCESSORIES

A. Provide all accessories required for a complete installation in accordance with the manufacturer's instructions.
B. Fasteners: Stainless steel, ribbed bugle-head type as recommended by panel manufacturer, of equal or greater holding power than required by manufacturer's Code compliance reports (Minimum ¼ penetration or three screw-threads). Finish: Match color of panels.
C. Insect screening for all open joints: PVC-coated, glass fiber fabric, 18-by-14 or 18-by-16.
D. Sheet Metal Flashings and Trim: Aluminum (In matching colors).
E. Edge Sealer: Type recommended by panel manufacturer.
F. Joint Sealers: Specified in Section 07 92 00.

PART 3 EXECUTION

3.1 PANEL INSTALLATION

A. Clean substrates of projections and substrates detrimental to application.
B. Install panel system in accordance with manufacturer's instructions and approved Shop Drawings, unless more stringent requirements apply.
C. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.
D. Provide minimum 8 inch clearance between panel system and finished grade.
E. Leave 1/2 inch gap between horizontal drainage flashings and bottom of panel above. Do not seal this space.
F. Allow minimum vertical clearance between edge of panel system and adjacent materials in accordance with manufacturer's instructions.
G. Cut panels to fit around penetrations with maximum 1/4 inch (6 mm) gaps. Smooth and seal cut edges.
H. Fasten panel system at maximum spacing per manufacturer's Code compliance reports. Place fasteners exposed, minimum 3/8 inch (10 mm) from panel edges and 2 inches (50 mm) from top and bottom edges at panel corners, in orderly fastening pattern.
I. Apply joint sealer between panel system and adjacent surfaces as specified in Section 079200 except at horizontal drainage flashings.
J. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.
K. Touch-up exposed cut edges with color matched paint.
L. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

3.2 TRIM INSTALLATION

A. Install materials in strict accordance with manufacturer's installation instructions. Install flashing around all wall openings.
B. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
C. Fasten through trim into structural framing or code complying sheathing. Fasteners must penetrate minimum 3/4 inch (19 mm) or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
D. Maintain clearance between trim and adjacent finished grade.
E. Trim inside corner with a single board trim both side of corner.
F. Outside Corner Board Attach Trim on both sides of corner with 16 gage corrosion resistant finish nail 1/2 inch (13 mm) from edge spaced 16 inches (406 mm) apart, weather cut each end spaced minimum 12 inches (305 mm) apart.
G. Allow 1/8 inch gap between trim and siding.

H. Seal gap with high quality, paint-able caulk.
I. Fasten through overlapping boards. Do not nail between lap joints.
J. Overlay siding with single board of outside corner board then align second corner board to outside edge of first corner board. Do not fasten HardieTrim boards to HardieTrim boards.

END OF SECTION 074646

SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adhered thermoplastic polyolefin (TPO) roofing system.
2. Accessory roofing materials.
3. Roof insulation.
4. Insulation accessories and cover board.
5. Walkways.

B. Related Requirements:

1. Section 07 62 00 “Sheet Metal Flashing and Trim” for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
2. Section 07 710 0 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.
3. Section 07 72 00 “Roof Accessories” for roof curbs, pipe portals, and preformed flashing sleeves.
4. Section 07 72 33 “Roof Hatches” for factory-fabricated roof hatches.
5. Section 07 76 00 “Roof Pavers” for roof paver units, pedestal support systems, and other system components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav or SPRI's Directory of Roof Assemblies listing.

B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with adjoining air barrier.

C. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installers: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.4 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. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.

B. Impact Resistance: Roof membrane to resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): As indicated on drawings.
2. Zone 2 (Roof Area Perimeter): As indicated on drawings.
3. Zone 3 (Roof Area Corners): As indicated on drawings.

D. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials 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: As indicated on drawings.

E. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

A. TPO Sheet: ASTM D6878/D6878M, internally fabric- or scrim-reinforced, TPO sheet.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Syntec Systems.
   b. Johns Manville; A Berkshire Hathaway Company
   c. GAF
   d. Holcim Elevate.
2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

   1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as TPO sheet.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard.

E. Slip Sheet: Manufacturer's standard, of thickness required for application.

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 ROOF INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 2, Grade 2, felt or glass-fiber mat facer on both major surfaces.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Atlas Polyiso Roof and Wall Insulation.
      b. Carlisle Syntec Systems.
      c. Hunter Panels.
   2. Size: 48 by 96 inches.
   3. Thickness:
      a. Base Layer: 1-1/2 inches.

b. Upper Layer: Built-up to achieve required R value indicated on drawings.

4. Compressive Strength: Required at roof pavers, minimum 60 psi.

B. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:
   a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
   b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.5 SUBSTRATE BOARDS

A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.

1. Thickness: Type X, 5/8 inch thick.
2. Surface Finish: Unprimed.

2.6 INSULATION ACCESSORIES AND COVER BOARD

A. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

B. Induction-Welding Plates: Minimum 3-inch diameter with recessed center, 0.034-inch thick, aluminum-zinc alloy-coated steel plates, factory-coated with adhesive formulated for roof membrane, with corresponding corrosion-resistant fasteners and thermal isolation spacers below plates.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Modified asphaltic, asbestos-free, cold-applied adhesive.

D. Polyisocyanurate Insulation Cover Board: ASTM C1289 Type II, Class 4, Grade 1, 1/2 inch thick, with a minimum compressive strength of 80 psi.

2.7 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches.
2. Color: Contrasting with roof membrane.

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 surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

3.2 PREPARATION

A. Perform fastener-pullout tests according to roof 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 ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav and 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 air barrier.

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

   a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.

3.5 INSTALLATION OF INSULATION

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

B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.

    a. Locate end joints over crests of decking.
    b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

        1) Trim insulation so that water flow is unrestricted.

    f. Fill gaps exceeding 1/4 inch with insulation.
    g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    h. Loosely lay base layer of insulation units over substrate.
    i. Mechanically attach base layer of insulation and substrate board using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

        1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification and SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
        2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

        1) Trim insulation so that water flow is unrestricted.

    f. Fill gaps exceeding 1/4 inch with insulation.

g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
h. Loosely lay each layer of insulation units over substrate.
i. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification, SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Wood Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood decks.

a. Fasten slip sheet according to requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
b. Fasten slip sheet to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows and end joints staggered not less than 12 inches in adjacent rows.

a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding with insulation.
f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
g. Loosely lay base layer of insulation units over substrate.

3. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to wood decks.

a. Fasten insulation according to requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
b. Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

4. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches (610 mm) in adjacent rows.
b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

f. Fill gaps exceeding 1/4 inch with insulation.
g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
h. Loosely lay each layer of insulation units over substrate.
i. Adhere each layer of insulation to substrate using adhesive according to SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

E. Place thermal spacers and plates on insulation in required fastening patterns to achieve FM rating and secure in accordance with manufacturer's instructions.

1. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch minimum into roof deck; do not overdrive fasteners.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.
   a. Trim cover board so that water flow is unrestricted.
3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Loosely lay cover board over substrate.
5. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification, SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
   a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
   b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
   c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. Install slip sheet over cover board and beneath roof membrane.

C. Place plates on insulation in required fastening patterns to achieve FM rating and secure in accordance with manufacturer’s instructions.

1. Install plates and fasteners tight and flat to substrate with no dimpling, and with fastener extending 1 inch minimum into roof deck; do not overdrive fasteners.

3.7 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. Hot Roofing Asphalt: Apply a solid mopping of hot roofing asphalt to substrate at temperature and rate required by manufacturer, and install fabric-backed roof membrane. Do not apply to splice area of roof membrane.

G. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

H. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

I. Apply roof membrane with side laps shingled with slope of roof deck where possible.

J. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof 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 roof membrane that do not comply with requirements.

K. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 INSTALLATION OF WALKWAYS

A. Flexible Walkways:

1. Install flexible walkways at the following locations:
   a. Retain one or more subparagraphs below. Revise to suit Project.
   b. Perimeter of each rooftop unit.
   c. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   d. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   e. Top and bottom of each roof access ladder.
   f. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
   g. Locations indicated on Drawings.
   h. As required by roof membrane manufacturer's warranty requirements.
2. Provide 6-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured reglets with counterflashing.
2. Formed roof-drainage sheet metal fabrications.
3. Formed low-slope roof sheet metal fabrications.
4. Formed steep-slope roof sheet metal fabrications.
5. Formed wall sheet metal fabrications.
6. Formed equipment support flashing.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 31 13 "Asphalt Shingles and Section 07 53 23 “Ethylene-Propylene-Diene-Monomer (EPDM) Roofing” for materials and installation of sheet metal flashing and trim integral with roofing.
3. Section 07 71 19 "Manufactured Fascia" for manufactured roof edge fascia covers.
4. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
5. Section 07 95 13.13 "Interior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
6. Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.2 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.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
3. Review requirements for insurance and certificates if applicable.
4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

1.5 INFORMATIONAL SUBMITTALS

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: 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.

1.8 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.

1.9 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, shall 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 shall not rattle, leak, or loosen, and shall 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. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent 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: 120 deg F , ambient; 180 deg F , material surfaces.

2.2 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish:
   a. 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.
2. Color: As selected by Architect from manufacturer's full range.
3. 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.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.

1. Finish: ASTM A480/A480M, No. 2D (dull, cold rolled) .
   a. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
   b. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
      1) Run grain of directional finishes with long dimension of each piece.
      2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.3 UNDERLAYMENT MATERIALS

A. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, 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 or manufactured item 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 or manufactured item.

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.
   c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Sheet: Copper, hardware bronze or passivated Series 300 stainless steel.
3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

4. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
5. Fasteners for Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:

1. For : ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead with maximum lead content of 0.2 percent.
2. For Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.

D. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

F. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

G. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fry Reglet Corporation.
   b. Hohmann & Barnard, Inc.
   c. OMG, Inc.
2. Source Limitations: Obtain reglets from single source from single manufacturer.
3. Material: Stainless steel, 0.0188 inch thick; Aluminum, 0.024 inch thick.
4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. Accessories:
   a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
9. Finish: Mill or with manufacturer's standard color coating when visible from grade.

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 feet 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, nonexpansion-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 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. 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.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:

1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Furnish flat-stock gutter brackets and twisted gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
4. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
5. Gutter Profile: Style J in accordance with cited sheet metal standard.
6. Expansion Joints: Butt type with cover plate or built in.
7. Gutters with Girth up to 15 Inches: Fabricate from the following materials:
   a. Aluminum: 0.032 inch thick.

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.

1. Hanger Style: Aluminum downspout band.
2. Fabricate from the following materials:
   a. Aluminum: 0.024 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

C. Flashing Receivers: Fabricate from the following materials:

1. Stainless Steel: 0.0156 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

2.8 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

B. Drip Edges: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

C. Eave, Rake, Ridge, and Hip Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

E. Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

F. Roof-Penetration Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

2.9 WALL SHEET METAL FABRICATIONS

A. Opening Flashings in Frame Construction: Fabricate head, sill, [jamb,] and similar flashings to extend [4 inches] <Insert dimension> beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Fabricate from the following materials:

1. Aluminum: [0.032 inch] <Insert dimension> thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Stainless Steel: 0.0188 inch thick.

B. Metal Brick Cap: Formed, one-piece, metal brick cap in section lengths not exceeding 12 feet, with a vertical flange and vertical leg, fascia terminating in a drip edge, and concealed splice plates of same material, finish, and shape as indicated on drawings. Provide matching corner units.

1. Formed Aluminum Brick Cap: Aluminum sheet, 0.050 inch thick.
    a. Surface: Smooth, flat finish.
    b. Finish: Two-coat fluoropolymer.
    c. Color: As selected by Architect from manufacturer's full range.
2. Corners: Mechanically clinched and sealed watertight.
3. Accessories: Hold-down cleats.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, 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 sheathing or backing 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. 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, 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, solder, 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 solder, welds or 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. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. 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 uncoated-aluminum and 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 feet 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 07 92 00 "Joint Sealants."

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.

1. Pretin edges of sheets with solder to width of 1-1/2 inches; however, reduce pretinning where pretinned surface would show in completed Work.
2. Do not solder aluminum sheet.
3. Do not pretin zinc-tin alloy-coated copper.
4. Do not use torches for soldering.
5. Heat surfaces to receive solder, and flow solder into joint.
   a. Fill joint completely.
   b. Completely remove flux and spatter from exposed surfaces.
6. Stainless Steel Soldering:
   a. Tin edges of uncoated sheets, using solder for stainless steel and acid flux.
   b. Promptly remove acid-flux residue from metal after tinning and soldering.
   c. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
7. Copper Soldering: Tin edges of uncoated sheets, using solder for copper.
8. Copper-Clad Stainless Steel Soldering: Tin edges of uncoated sheets, using solder for copper-clad stainless steel.

H. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Hanging Gutters:

1. Join sections with riveted and soldered joints or joints sealed with sealant.
2. Provide for thermal expansion.
3. Attach gutters at eave or fascia to firmly anchor them in position.
4. Provide end closures and seal watertight with sealant.
5. Slope to downspouts.
6. Fasten gutter spacers to front and back of gutter.
7. Anchor gutter with spikes and ferrules spaced not more than 24 inches apart.
8. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.
5. Connect downspouts to underground drainage system.

D. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements , sheet metal manufacturer's written installation instructions, 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. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

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 snap-in installation and sealant or lead wedges and sealant 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 or butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL FLASHINGS

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.

3.7 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:

1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
2. Weld or seal flashing with elastomeric sealant to equipment support member.

3.8 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.10 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 076200

SECTION 076526 - SELF-ADHERING SHEET FLASHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Self-adhering through-wall flashing and accessory products.

B. Materials and installation of self-adhering through-wall flashing assemblies as indicated on drawings.

C. Through-wall flashing and accessories for installation in cavity wall construction in the following locations:
   1. Wall bases
   2. Window sills
   3. Heads of openings
   4. Shelf angles
   5. Tops of walls
   6. Parapets
   7. At other discontinuities in the cavity.

1.2 RELATED SECTIONS

A. Section 033000 - Cast-In-Place Concrete: Concrete back-up walls, concrete footer.

B. Section 042000 - Unit Masonry: concrete masonry unit (CMU) back-up walls.

C. Section 07 21 00 - Thermal Insulation: Board insulation applied to exterior side of wall.

D. Section 07 27 26 – Burn Resistant, Fluid-Applied, Vapor-Permeable Membrane Air Barriers.

E. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal through- wall flashings, metal drip edge.

F. Section 07 90 00 - Joint Protection: Joint sealant materials and installation.

G. Section 09 29 00 - Gypsum Sheathing: Gypsum sheathing over metal studs.

1.5 PERFORMANCE REQUIREMENTS

A. Provide a membrane constructed to perform as a through-wall flashing durably integrated with the wall assembly's water resistive barrier and cavity drainage system. The installed through-wall flashing shall perform as a liquid water drainage plane to discharge incidental condensation or water penetration to the exterior through the cavity drainage system.

B. Provide a fully-adhered, water proof membrane through-wall flashing of minimum 0.040 inch (40 mils) thickness consisting of 0.032 inch (32 mils) rubberized asphalt adhesive fully-coating 0.008 inch (8 mils) smooth surface, cross-laminated HDPE film. Membrane shall meet the following requirements:

REQUIREMENT	RESULT	TEST METHOD
Tensile Strength	Not less than 900 psi	ASTM D-412
Puncture Resistance	Not less than 80 lb.	ASTM E 154
Low Temperature Flexibility	Unaffected at minus 25 degrees F, 0.063 inch mandrel	ASTM D 146
Peel Adhesion	Not less than 5 lb per inch width on concrete prepared with contact	ASTM D 903
Lap Adhesion	Not less than 5 lb. per inch width	ASTM D 1876
Water Vapor	Not more than 0.05 Perm	ASTM E-96, Method B
Water Absorption	Not more than 0.12 percent by weight	ASTM D 570

1.6 SUBMITTALS

A. Manufacturer's technical data sheets and material safety data sheets for Product and Accessories.

B. Certification of compatibility by Manufacturer, listing all materials on the Project with which the Product and Accessories may come into contact.

C. Samples of Product minimum 3 inch by 4 inch size.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be experienced in applying the same or similar materials and shall be specifically approved in writing by Manufacturer.

B. Single-Source Responsibility: Obtain Product and Accessories from single manufacturer.

C. Product and Accessories shall comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, lot number and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by Manufacturer.

C. Protect stored materials from direct sunlight. Do not store cylinders of Aerosol Contact Adhesive above 110 degrees F.

D. Avoid spillage. Immediately notify Owner, [Architect] [Consultant] if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

1.10 PROJECT CONDITIONS

A. Do not apply during rain or accumulating snowfall.

B. Applicator shall have full, safe access to area

C. Apply Product and accessories within temperature range indicated in Manufacturer's literature.

1.11 WARRANTIES: Provide the Manufacturer's minimum five year material warranty.

PART 2 PRODUCTS

2.1 Basis-of-Design Product: Provide as manufactured by Carlisle Coatings & Waterproofing, Incorporated. 900 Hensley Lane, Wylie, TX 75098. Phone 1-800-527-7092. Website http://www.carlisleccw.com. Provide basis of design product, or comparable product approved by Architect.

A. Standard: CCW-705 TWF

B. Low-Temp: CCW-705 TWF LT

2.2 ACCESSORIES: Provide manufacturer recommended adhesives, mastics, fillers, and termination bars. Accessories compatible with basis-of-design products: as manufactured by Carlisle Coatings & Waterproofing, Incorporated.

A. Contact Adhesive, select one:
1. CCW-702 or CCW-702 LV Solvent-Based
2. CCW-702 WB Water-Based
3. CAV-GRIP™ Aerosol Spray

B. Mastic:LM 800 XL solvent-based synthetic rubber

C. Fill Compound:
1. CCW-703 V Modified polyurethane, 2-part
2. LM 800 XL Solvent-based, synthetic rubber, 1-part
3. CCW-201 Polyurethane, 2-part

D. Termination Bar: SURE-SEAL™ Termination Bar

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions affecting installation of the through-wall flashing and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Concrete shall be cured for a minimum of seven days.

C. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.

D. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.

E. Ledge, footing, shelf angle or lintel surfaces shall be flat, or preferably sloped to provide drainage to the exterior. Surfaces shall not be oriented so that water can pond on the through-wall flashing.

F. Inform Architect [Consultant] [Owner] in writing of anticipated problems applying Product over substrate.

3.2 SURFACE PREPARATION

A. Fill joints and cracks greater than ¼ inch width with Fill Compound struck flush.

B. Fill inside corners and angle changes with minimum ½ inch tooled bead of Fill Compound.

3.3 INSTALLATION

A. Allow Fill compound used in Article 3.02 to cure fully before applying Product.

B. Apply Product to sound substrate. Do not apply over mechanically- attached water resistive barrier such as felt, paper or house wrap.

C. Prepare all surfaces accepting Product with Contact Adhesive. Observe installation instructions, including coverage rates and drying times, indicated in Manufacturer's literature.

D. Apply Product over prepared surfaces according to Manufacturer's instructions and drawings.

E. Apply Mastic to edges of Product at laps, cuts and penetrations.

F. Secure vertical termination of Product with Termination Bar and Mastic, reglet with Mastic, or cast-in-place according to Manufacturer's instructions and drawings.

G. Keep edge of product at least ½ inch away from exterior finish.

3.4 SCHEDULE

A. Install through-wall flashing during or after construction of back-up wall.

B. Install through-wall flashing before or during installation of brick veneer.

C. Lap water resistive barrier over vertical termination of through-wall flashing on back-up wall. Lap and secure water resistive barrier according to water resistive barrier manufacturer's instructions.

D. Integrate through-wall flashing with adhered membrane air barrier, damp proofing or water-resistive barrier according to Manufacturer's instructions and drawings.

3.5 REPAIR AND PROTECTION

A. Protect from damage during application and remainder of

construction period.

B. Inspect before covering and make repairs according to Manufacturer's instructions.. Remove and replace damaged material.

C. Product is not designed for permanent exposure. Cover with exterior cladding as soon as schedule allows.

D. Outdoor exposure of installed Product shall not exceed 60 days.

END OF SECTION 076526

SECTION 077119 – MANUFACTURED FASCIA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fascia system.

1.2 RELATED REQUIREMENTS

A. Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for roofing system.

1.3 REFERENCE STANDARDS

A. Single Ply Roofing Industry (SPRI) (www.spri.org):
1. ANSI/SPRI/FM 4435/ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.

1.4 ACTION SUBMITTALS

B. Product Data: Submit manufacturer's product data, including installation instructions.

C. Shop Drawings: Submit manufacturer's shop drawings, including plans, elevations, sections, and details, indicating dimensions, materials, components, fasteners, finish, and accessories.

D. Samples: Submit manufacturer's sample of fascia system.
1. Sample Size: Minimum 6 inches long.

E. Color Samples: Submit manufacturer's color samples of exterior fascia covers, consisting of complete set of metal color chips representing manufacturer's full range of available colors.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certification: Submit manufacturer's certification that materials comply with specified requirements and are suitable for intended application.

B. Warranty Documentation: Submit per Section 075323 "ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING."

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer regularly engaged in the manufacturing of fascia systems of similar type to that specified for a minimum of 15 years.

B. Installer's Qualifications:
   1. Installer regularly engaged in installation of fascia systems of similar type to that specified for a minimum of 5 years.
   2. Use persons trained for installation of fascia systems.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
   3. Store materials in clean, dry area indoors.
   4. Do not store materials directly on floor or ground.
   5. Protect materials and finish during storage, handling, and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: OMG EdgeSystems, 4 Commerce Way, Arden, North Carolina 28704. Toll Free 800-892-9173. Phone 828-676-1700. www.omgedgesystems.com. info@omgedgesystems.com.

B. Substitutions: Not permitted.

C. Single Scource: Furnish materials from single manufacturer.

2.2 FASCIA SYSTEM

A. Fascia System: "TerminEdge" fascia with formed galvanized steel retainer for single-ply roofing.

   6. Face Size: Indicated on the Drawings.
   7. Tested: ANSI/SPRI/FM 4435/ES-1 test pressures up to 381 psf horizontal.
   8. Approvals:
      a. UL Classified.
      b. FM Approved.
      c. Miami-Dade County Approved.
      d. Florida Product Approval.
   9. Formed Retainer:
      a. Material: 20-gauge galvanized steel.
      b. Formed Lengths: 10'-0".
   10. Exterior Fascia Covers:
      a. Material: 0.050-inch aluminum.
      b. Formed Lengths: 10'-0".
      c. Finish: Prefinished Kynar.
      d. Color: As selected by Architect from manufacturer's full range.

11. Concealed Joint Splices:
    a. Splice Plates: 0.040-inch aluminum or 24-gauge galvanized steel.
    b. Finish and Color: Same as exterior fascia covers.
    c. Width: 4 inches.
12. Fasteners:
    a. Universal Fasteners: E-coated, corrosion resistant.
    b. Suitable for intended substrate.
    c. Provided by fascia system manufacturer.
13. Sealant:
    a. Non-hardening waterproof sealant.
    b. Compatible with fascia system and roofing.
    c. Provided by roofing manufacturer.
    d. Specified in Section 079200 "Joint Sealants".
14. Accessory Type: Welded or Folded.
15. Accessories:
    a. Material, Finish, and Color: Same as exterior fascia covers.
    b. Miters:
        1) Outside.
        2) Inside.
    c. End Caps:
        1) Left.
        2) Right.
    d. End Terms:
        1) Left.
        2) Right.
    e. Sumps.
    f. Spillouts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roof edge areas, including roofing and blocking, to receive fascia system.

B. Verify surfaces to support fascia system are clean, dry, straight, secure, and of proper dimensions.

C. Notify Architect, Owner's representative, and roofing installer of conditions that would adversely affect installation.

D. Do not begin installation until unacceptable conditions are corrected.

3.2 INSTALLATION

A. Install fascia system in accordance with manufacturer's instructions at locations indicated on the Drawings.

B. Roofing: Specified in Section 075323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing".

C. Fasteners:
   1. Install fascia system using concealed fasteners in accordance with manufacturer's instructions.
   2. Do not penetrate horizontal roofing surface with fasteners.

D. Sealant: Apply continuous beads of sealant in accordance with manufacturer's instructions.

E. Thermal Expansion: Create gap between retainer sections and between fascia sections in accordance with manufacturer's instructions to allow for thermal expansion.

F. Review lengths of straight pieces of exterior fascia covers before cutting to avoid creating relatively short sections adjacent to full-length sections.

G. Isolate fascia system from ACQ treated wood blocking or other galvanically incompatible material with appropriate material.

3.3 CLEANING

1. Clean fascia system promptly after installation in accordance with manufacturer's instructions.
2. Remove clear protective vinyl film.
3. Do not use harsh cleaning materials or methods that could damage finish.

3.4 PROTECTION

1. Protect installed fascia system to ensure that, except for normal weathering, fascia system will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 077119

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof curbs.
2. Pipe portals.
3. Preformed flashing sleeves.

B. Related Requirements:

1. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
2. Section 077100 "Roof Specialties" for manufactured fasciae, copings, gravel stops, gutters and downspouts, and counterflashing.

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pate Company (The).
   b. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported .

D. Material: Zinc-coated (galvanized) steel sheet, 0.064 inch thick.

1. Finish: Baked enamel or powder coat .
2. Color: As selected by Architect from manufacturer's full range .

E. Construction:

1. Curb Profile: Manufacturer's standard compatible with roofing system.
2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
3. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
6. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
7. Nailer: Factory-installed wood nailer along top flange of curb , continuous around curb perimeter.
8. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.3 PIPE PORTALS

A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Portals Plus; a division of Hart & Cooley, Inc.

B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Portals Plus; a division of Hart & Cooley, Inc.

2.4 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and slotted metal collar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Custom Solution Roof and Metal Products.
2. Metal: Aluminum sheet, 0.063 inch thick.
3. Diameter: As indicated on Drawings .
4. Finish: Manufacturer's standard .

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Custom Solution Roof and Metal Products.
2. Metal: Aluminum sheet, 0.063 inch thick .
3. Height: 7 inches .
4. Diameter: As indicated on Drawings .
5. Finish: Manufacturer's standard .

2.5 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.

1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.

4. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
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 a minimum total dry film thickness of 0.5 mil.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.

1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
3. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
4. Concealed Finish: Pretreat with 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.

C. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.
2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
3. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
4. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
5. Exposed Coil-Coated Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Two-Coat Fluoropolymer Finish: AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
6. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
7. Concealed Finish: Pretreat with 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.

D. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

E. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

F. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

G. Steel Tube: ASTM A500/A500M, round tube.

H. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

I. Steel Pipe: ASTM A53/A53M, galvanized.

2.6 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.

C. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

D. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Underlayment:

1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D4397.
3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, 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.

H. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.

I. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

J. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

K. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

L. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum or stainless steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Gravity Ventilator Installation: Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

F. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

G. Preformed Flashing-Sleeve and Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

H. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 077200 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide factory-fabricated roof hatches for ladder access.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data.

B. Shop Drawings: Submit shop drawings including profiles, accessories, location, adjacent construction interface, and dimensions.

C. Warranty: Submit executed copy of manufacturer's standard warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer: A minimum of 5 years experience manufacturing similar products.

B. Installer: A minimum of 2 years experience installing similar products.

C. Manufacturer's Quality System: Registered to ISO 9001 Quality Standards including in-house engineering for product design activities.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original packaging. Store materials in a dry, protected, well-vented area. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on the carrier's freight bill of lading.

1.5 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard warranty. Materials shall be free of defects in material and workmanship for a period of five years from the date of purchase. Should a part fail to function in normal use within this period, manufacturer shall furnish a new part at no charge.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis-of-Design Manufacturer: Type E Roof Hatch by The BILCO Company, P.O. Box 1203, New Haven, CT 06505, 1-800-366-6530, Fax: 1-203-535-1582, Web: www.BILCO.com. Provide basis of design product, or comparable product approved by Architect.

2.2 ROOF HATCH

A. Furnish and install where indicated on plans metal roof hatch Type E, size width: 36 inches x length: 36 inches. Length denotes hinge side. The roof hatch shall be single leaf. The roof hatch shall be pre-assembled from the manufacturer.

B. Performance characteristics:

1. Cover shall be reinforced to support a minimum live load of 40 psf with a maximum deflection of 1/150th of the span or 20 psf wind uplift.
2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
3. Operation of the cover shall not be affected by temperature.
4. Entire hatch shall be weather tight with fully welded corner joints on cover and curb.

C. Cover: Shall be 11 gauge aluminum with a 3 inch beaded flange with formed reinforcing members. Cover shall have a heavy extruded EPDM rubber gasket that is bonded to the cover interior to assure a continuous seal when compressed to the top surface of the curb.

D. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

E. Cover insulation: Shall be fiberglass of 1 inch thickness, fully covered and protected by a metal liner of 18 gauge aluminum.

F. Curb: Shall be 12 inches in height and of 11 gauge aluminum. The curb shall be formed with a 3-1/2 inch flange with 7/16 inch holes provided for securing to the roof deck. The curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, fully welded at the corners, that features the Bil-Clip® flashing system, including stamped tabs, 6 inches on center, to be bent inward to hold single ply roofing membrane securely in place.

G. Curb insulation: Shall be rigid, high-density fiberboard of 1 inch thickness on outside of curb.

H. Lifting mechanisms: Manufacturer shall provide compression spring operators enclosed in telescopic tubes to provide, smooth, easy, and controlled cover operation throughout the entire arc of opening and closing. The upper tube shall be the outer tube to prevent accumulation of moisture, grit, and debris inside the lower tube assembly. The lower tube shall interlock with a flanged support shoe welded to the curb assembly.

I. Hardware

1. Heavy pintle hinges shall be provided
2. Cover shall be equipped with a spring latch with interior and exterior turn handles

3. Roof hatch shall be equipped with interior and exterior padlock hasps.
4. The latch strike shall be a stamped component bolted to the curb assembly.
5. Cover shall automatically lock in the open position with a rigid hold open arm equipped with a 1" (25mm) diameter red vinyl grip handle to permit easy release for closing.
6. All hardware shall be zinc plated and chromate sealed. For installation in highly corrosive environments or when prolonged exposure to hot water or steam is anticipated, provide Type 316 stainless steel hardware.
7. Cover hardware shall be bolted into heavy gauge channel reinforcing welded to the underside of the cover and concealed within the insulation space.

J. Finishes: Factory finish shall be mill finish aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install products in strict accordance with manufacturer's instructions and approved submittals. Locate units level, plumb, and in proper alignment with adjacent work.

1. Test units for proper function and adjust until proper operation is achieved.
2. Repair finishes damaged during installation.
3. Restore finishes so no evidence remains of corrective work.

3.3 ADJUSTING AND CLEANING

A. Clean exposed surfaces using methods acceptable to the manufacturer which will not damage finish.

END OF SECTION 077233

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Penetration firestopping systems for the following applications:
   a. Penetrations in fire-resistance-rated walls.
   b. Penetrations in horizontal assemblies.

B. Related Requirements:

1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.5 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. 3M Fire Protection Products.
   b. Hilti, Inc.
   c. Tremco, Inc.

B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.

D. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ProVent Systems, Inc.
   b. RectorSeal Firestop; a CSW Industrials Company.

2. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
5. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

E. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

2.2 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.

C. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

D. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

E. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

F. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

G. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.6 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."

C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide" under "Wall and Floor Penetration Fire Stops."

D. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-K-] [W-L-] [W-N-] [1001-1999].

2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used.

E. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-K-] [W-L-] [W-N-] [2001-2999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used

F. Penetration Firestopping Systems for Electrical Cables:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-K-] [W-L-] [3001-3999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used

G. Penetration Firestopping Systems for Insulated Pipes:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [C-BK-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-L-] [W-N-] [5001-5999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used

H. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants"

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [W-L-] [W-J-] [6001-6999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used

I. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-L-] [W-N-] [7001-7999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used

J. Penetration Firestopping Systems for Groupings of Penetrants:

1. UL-Classified Systems: [C-AJ-] [C-BJ-] [F-A-] [F-B-] [F-C-] [F-E-] [W-J-] [W-L-] [8001-8999].
2. Type of Fill Materials: As required to achieve rating.
3. Contractor shall be responsible for obtaining AHJ approval for preferred fire stop system used.

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 079513.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 PROJECT CONDITIONS

A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.4 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
        1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. 3M Fire Protection Products.
    b. Hilti, Inc.
    c. Tremco, Inc.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.

C. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. 3M Fire Protection Products.
    b. Hilti, Inc.
    c. Tremco, Inc.
2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.

D. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:

1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

3.6 JOINT FIRESTOPPING SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.

B. Floor-to-Floor, Joint Firestopping Systems FRJS-<#>:

1. UL-Classified Systems: FF- [D] [S] - [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

C. Wall-to-Wall, Joint Firestopping Systems FRJS-<#>:

1. UL-Classified Systems: WW- [D] [S] [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

D. Floor-to-Wall, Joint Firestopping Systems FRJS-<#>:

1. UL-Classified Systems: FW- [D] [S] - [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems FRJS-<#>:

1. UL-Classified Systems: HW- [D] [S] - [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

F. Bottom-of-Wall, Joint Firestopping Systems FRJS-<#>:

1. UL-Classified Systems: BW- [D] [S] - [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

G. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards FRJS-<#>:

1. UL-Classified Systems: CG- [D] [S] - [0000-0999] [1000-1999] [2000-2999] [3000-3999] [4000-4999].

H. Perimeter Joint Firestopping Systems PFRJS-<#>:

1. UL-Classified Perimeter Fire-Containment Systems: CW- [D] [S] - [0000-0999] [1000-1999] [2000-2999].

END OF SECTION 078443

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silicone joint sealants in joints exposed to water in areas of building interior.
2. Urethane joint sealants in vertical joints of the exterior of the building.
3. Latex joint sealants in joints of the interior of the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Joint-sealants.
2. Joint sealant backing materials.

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.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

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.

PART 2 - PRODUCTS

2.1 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. VOC Content: Verify sealants and sealant primers comply with the following:

1. Architectural sealants have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for porous substrates have a VOC content of 775 g/L or less.
3. Sealants and sealant primers for nonporous substrates have a VOC content of 250 g/L or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pecora Corporation.
   b. Sika Corporation; Joint Sealants.
   c. The Dow Chemical Company.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Sika Corporation; Joint Sealants.

2.4 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pecora Corporation.

b. Sherwin-Williams Company (The).
c. Tremco Incorporated.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: 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.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Adfast.
   b. Alcot Plastics Ltd.
   c. Construction Foam Products; a division of Nomaco, Inc.
   d. Master Builders Solutions.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin) Type O (open-cell material) Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. 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.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.
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 according to 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.
4. Provide flush joint profile at locations indicated on Drawings in accordance with Figure 8B in ASTM C1193.
5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

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

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Exterior joints in horizontal traffic surfaces:

1. Joint Locations:

a. Isolation and contraction joints in cast-in-place concrete slabs.
b. Joints between different materials listed above.
c. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Exterior joints in vertical surfaces and horizontal nontraffic surfaces:

1. Joint Locations:
   a. Control and expansion joints in unit masonry.
   b. Perimeter joints between materials listed above and frames of doors windows and louvers.
   c. Control and expansion joints in ceilings and other overhead surfaces.
   d. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, M, P, 50, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Interior joints in horizontal traffic surfaces:

1. Joint Locations:
   a. Isolation joints in cast-in-place concrete slabs.
   b. Control and expansion joints in tile flooring.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. 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 and windows.
   c. Joints between dissimilar materials.
   d. 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.

E. Interior joints in vertical surfaces and horizontal nontraffic surfaces subject to water exposure:

1. Joint Locations:
   a. Plumbing fixtures.
   b. Perimeter joints between interior wall surfaces and countertops.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes hollow-metal work for doors and frames

B. Related Requirements:
1. Section 04 20 00 “Unit Masonry” for grouting frames in masonry.
2. Section 08 16 50 “Composite Entry Doors” for pre-hung entrance door frames.
3. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work 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.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Curries Company; an Assa Abloy Group company.
2. Republic Doors and Frames.
3. Steelcraft; an Ingersoll-Rand company.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. Typical Interior door and frame.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches (44.5 mm).
    c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.042 inch (1.0 mm).
    d. Edge Construction: Model 1, Full Flush.
    e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
    f. Door lites: Provide 100 sq. inch door lites in all stairway doors

3. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
b. Construction: Knocked down.

4. Exposed Finish: Prime.

2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. All exterior doors and frames.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm.)
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
d. Edge Construction: Model 1, Full Flush.
e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
f. Core: Mineral board.

1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.

3. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
b. Construction: Knocked down.

4. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

2.6 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: 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.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Grout Materials: Grout hollow metal frames solid with Isolatek CAFCO 300.

K. Bituminous Coating: Cold-applied asphalt mastic, 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.

2.7 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
2. Top Edge Closures: Close top edges of doors with inverted closures of same material as face sheets.

3. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
4. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) high.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.

    c. Compression Type: Not less than two anchors in each frame.

4. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
5. 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.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

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

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with [butted] [or] [mitered] hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 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 SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

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

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install door silencers in frames before grouting.
    d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or spray applied fire proofing.
4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    c. At Bottom of Door: [3/4 inch (19.1 mm)] [5/8 inch (15.8 mm)] plus or minus 1/32 inch (0.8 mm).
    d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081217 – PRE-FINISHED STEEL DOOR FRAMES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work under this section shall include the furnishing of all items shown on the drawings and as specified, including but not limited to, the following:

1. Knocked down, site assembled prefinished steel door frames

2. Knocked down, site assembled sidelight, borrowed light, transom, and fullbound access door frames

3. Knocked down, site assembled prefinished steel double egress frames

4. Pocket trim jambs and casings (Pocket frame and hardware not included)

1.2 RELATED SECTIONS

A. Section 081113 – Hollow Metal Doors and Frames

B. Section 081600 – Composite Doors

C. Section 087100 - Hardware

D. Section 088000 - Glazing

1.3 SUBMITTALS

A. Product Data: Indicate frame material, gauge, configuration and finishes.

B. Shop Drawings: Indicate frame elevations, details of frame anchorage, reinforcements required, rough opening requirements, location of hardware embosses and finishes. Detail each floor of the building separately.

C. Samples: Submit standard frame samples, illustrating factory finished frame colors.

D. Manufacturer's Installation Instructions: Provide installation instructions for all products under this section.

E. Manufacturer's Certificate of Warranty: Provide manufacturer’s standard warranty certificate stating material is warranted for a period of one year from date of building occupancy

1.4 QUALITY ASSURANCE

A. Quality Standards

1. Material free from defects in material and according to project specifications for pre-engineered opening systems

2. Proven durability of factory finishes allowing for bending and shaping of material after finish is applied

B. Fire Rated Frame Construction

1. Conform to ASTM E152, NFPA 252, UL 10B and 10C.

C. Installed Frame Assembly: Conform to NFPA 80

1. Use only installers familiar with installation of prefinished opening systems and applied casing frame installation

1.5 DELIVERY, STORAGE AND HANDLING INCLUDED

A. Transport, handle, store, and protect products in a dry area off the ground.

B. Accept frames on site in manufacturer's box packaging with identification labels intact. Inspect for damage.

C. Do not open individual boxes until installation is to begin.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Timely Industries knocked down, site assembled prefinished steel door frames. Provide basis of design product, or comparable product approved by Architect.

1. Timely Industries, A Division of SDS Industries, Inc.

2. Dunbarton Corporation; Rediframe.

B. Frames: Provide door frames as shown on drawings and door schedule.

2.2 FRAMES

A. Frame Material: Hot dipped galvanized steel, for interior frames in normal atmospheric exposures.

B. Frame Material: Hot dipped galvanized steel for all frames used in the following locations:

1. Exterior Locations

2. Public and Private Restrooms

3. Areas subject to corrosive chemicals or high humidity

4. Coastal locations for both interior and exterior applications exposed to salt air or salt spray within 10 miles of any ocean or salt water lake.

C. Frame Throat Opening: As shown on plan details to suit finished wall thickness.

D. Where shown, fire rated frames to have kerf formed into frame profile for installation of smoke gasket or weatherstrip material

E. Frame Profile - Unequal Rabbet profile, standard with manufacturer

2. “C” Series, 1.2 mm (18 gauge) thick

G. Casings

1. Provide Steel Casings formed to be applied to heat treated clips on frame face after frame is anchored to wall

2. Standard Steel - TA-8 with 6 mm (1/4 inch) reveal, on steel, stainless steel, and/or brass frames. Fit factory assembled units with MiterGard corner alignment clips. Provide TA-21(Floral design) or TA-22 (Saturn design) corner rosettes if shown.

3. FRAME REINFORCEMENT AND ACCESSORIES

A. Provide reinforcements shipped loose to project site for hardware application

1. Provide hinge reinforcement (TA-11) of 14 gauge steel pierced to create depth of thread equal to or greater than 7 ga. steel

2. Provide cut-outs and reinforcements for other mortised hardware as listed in section 08 71 00

B. Weatherstrip/Smoke Gasket: TA-46 (QDS500) 90 minute rated gasket for kerfed frames. Provide for all CK Series frames with factory installed gasket. Provide manufacturer's standard colors to closely match frame color. (Custom colors not available on TA-46). Provide TA-46I gasket with intumescent material when using category B doors.

C. Silencers: TA-5 vinyl, clear stick-on type. Silencers not required on Kerfed frames or frames schedule to receive stop mounted gasket or weatherstrip

D. Glass Stops: TA-14 removable rolled steel, shape, butted ends. Pre-punch and countersink for flat head tek screws. Provide stop with fastener location not more than 2" from end for all fire rated glazed openings.

E. Adjustable strikes: Emboss frames for TA-1 strike for cylindrical lock. Provide TA-1 strike in finish compatible with hardware finish. (Strike supplied with cylindrical lock cannot be used with standard frame because of unique strike location and screw piercing method)

F. Prepare frames for ASA 4-7/8" strikes where required. Provide minimum ¼" depth of threads in factory tapped screw holes

G. Installation fasteners (Provided by others)

1. Interior Frames: #6 Drywall type length sufficient to penetrate studs or structure at least ½".

2. Exterior Frames: Drywall type, corrosion resistant coating, same as G.1 above

2.3 FABRICATION

A. Openings for single swing, pair, borrowed light and sidelight frames to be pre-cut, notched and fabricated at the manufacturer's facility. For fire rated and exterior openings, provide kerf at stop for installation of smoke gasket or weatherstrip

B. Provide 14 gauge hinge reinforcement plate. Hinge reinforcement plate to be mechanically attached to hinge emboss on frame

C. Casing Clips: Fabricate frames with factory applied, heat treated clips to ensure no deflection in the clip upon application or removal of casing. Attachment clips may not be of same material as frame

D. Provide notches, tabs and/or stops for positive alignment of frame parts at all corners

E. Mullions to be notched as required to provide tight joints

F. Provide manufacturer's standard mullion brackets for positive connection of frame and mullion parts

G. Provide manufacturer's standard steel glass stop pre-cut to exact length. Fire rated glazed openings to have hole for installation screw within 2" of each end of stop piece

H. Provide insert channel full width of borrowed lights installed on finish floor. Provide full width head channel for ceiling height units.

I. Provide adequate structure or structural support for insert channel for ceiling height frames

J. Transoms bars fixed type with same profiles as jamb and head

K. Attach approved mylar label to each fire-rated frame indicating fire rating details

L. Primed frames to have 90 minute fire label embossed into frame in lieu of mylar label

M. Factory install TA-46 or TA-46I gasket on all prefinished, CK series frames. Install with factory mitered corners to ensure adequate seal and pleasing appearance

2.4 FINISHING

A. Frame Units: Prefinished with factory applied impact resistant, polyurethane baked enamel finish or optional electrostatic applied water based paint system

B. Frames for high humidity areas to be hot dipped galvanized. See 2.02.B for specific locations

C. Casing Finishes

1. Steel: Prefinished with factory applied impact resistant, polyurethane baked enamel finish.
2. Primer: Hot Dipped Galvanized with 2 coats of white prime paint

D. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify acceptability of existing conditions before starting work.

B. Verify that opening sizes and wall thicknesses are within specified tolerances. Verify that all finished walls are in plane to ensure proper door alignment.

3.2 INSTALLATION

A. Install frames in accordance with manufacturer's requirements.

B. Anchor frames with screws located at every casing clip or every 11" as shown on manufacturer's instructions. Field verify quantity and location of fasteners prior to installing casing.

C. Install prefinished frames near end of the project after wall painting and wall coverings.

D. Install frames using qualified installers familiar with installation of prefinished drywall frames.

E. Coordinate installation of glass and glazing in glazed units.

F. Coordinate installation of frames with installation of hardware specified in Section 08 71 00 and doors in Section 08 21 00.

G. Touch-up blemishes on finished frames with factory prepared touch up paint.

END OF SECTION 081217

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Five-ply flush wood veneer-faced doors for transparent finish.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.
2. Section 099300 "Staining and Transparent Finishing" for field finishing doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

1. Door core materials and construction.
2. Door edge construction
3. Door face type and characteristics.
4. Door louvers.
5. Door trim for openings.
6. Door frame construction.
7. Factory-machining criteria.
8. Factory- finishing specifications.

B. 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.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.
10. Apply Program label to Shop Drawings.

C. Samples for Initial Selection: For factory-finished doors.

1.3 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: Program certificates.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.4 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 bottom rail with opening number used on Shop Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

B. Environmental Limitations: 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 25 and 55 percent during remainder of construction period.

1.6 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 shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

1. Provide labels and certificates from certification program indicating that doors comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Eggers Industries.
   b. Graham Wood Doors, ASSA
2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
3. Performance Grade:
   a. ANSI/WDMA I.S. 1A Heavy Duty unless otherwise indicated on Drawings.
4. ANSI/WDMA I.S. 1A Grade: Premium.
5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
   a. Species: White oak.
   b. Cut: Plain sliced (flat sliced).
   c. Match between Veneer Leaves: Book match.
   d. Assembly of Veneer Leaves on Door Faces: Running match.

e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
g. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
h. Blueprint Match: Where indicated, provide doors with faces produced from same flitches as adjacent wood paneling and arranged to provide blueprint match with wood paneling. Comply with requirements in Section 064216 "Flush Wood Paneling."

6. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.
   a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
   b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
   c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
      1) Finish steel edges and astragals with baked enamel same color as doors.
      2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
   d. 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: 475 lbf in accordance with WDMA T.M. 10.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
   a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

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.
2. Comply with NFPA 80 requirements for fire-rated doors.

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.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

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 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

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 bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Premium.
2. Finish: ANSI/WDMA I.S. 1A TR-6 Catalyzed Polyurethane.
3. Staining: Match finish of existing doors.
4. Effect: Open-grain finish.
5. Sheen: Satin.

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 087100 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. 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.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
   a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
   a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
   b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
   c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
   d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

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 081416

SECTION 081600 - COMPOSITE DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following composite doors:
   1. Pre-finished twenty-minute fire-rated solid-core Composite Doors.
   2. Molded-Hardboard-Faced Wood Doors within Residential Units.

B. Related Requirements:
   1. Section 06 20 23 “Interior Finish Carpentry” for wood trim.
   2. Section 07 92 00 “Joint Sealants” for caulking around door frames.
   3. Section 08 71 00 "Door Hardware" for door hardware for composite wood doors.
   4. Section 09 91 23 “Interior Painting” for painting doors.

1.2 SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings.

C. Schedule: Provide a schedule of work 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.

1.3 DELIVERY, STORAGE AND HANDLING

A. Deliver doors, materials and components in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store doors as recommended by manufacturer.

1.4 WARRANTY

A. Manufacturer standard warranty indicating that the door will be free from material and workmanship defects from the date of substantial completion for the time periods indicated below:

1. Door Unit: 5 years

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. JELD-WEN Interior Doors
2. Masonite International Corp.
3. Door America

2.2 MOLDED-HARDBOARD-FACED WOOD DOORS

A. Residential Unit Entry Doors:
1. Thickness: 1-3/4 inch.
2. Rating: 20 Minute
3. Color and Finish: See Interior Design Drawings.
4. Paint: For painting, see Section 099123 "Interior Painting."
5. Door Style: See Drawings
6. Core and Frame: Solid or Mineral core with MDF frame.
7. Jambs: For installation, see Section 081217 "Pre-Finished Steel Door Frames"

B. Residential Unit Interior Doors:
1. Thickness: 1-3/8 inch.
2. Color and finish: See Interior Design Drawings.
3. Paint: For painting, see Section 099123 "Interior Painting."
4. Door Style: See Drawings
5. Core and Frame: Hollow core with MDF frame.
6. Jambs:
   a. Jamb Width: Varies
   b. Jamb Type: Flat
   c. Jamb Species: Finger-Jointed Pine

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 087100 "Door Hardware."

B. Wood Trim: For installation, see Section 062023 “Interior Finish Carpentry.”

C. Install doors and frames 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. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
    a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

F. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

G. 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 081600

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

B. Related Requirements:

1. See drawings for "Air Duct Accessories" for heating and air-conditioning duct access doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details , fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Karp Associates, Inc.
   b. MIFAB, Inc.
   c. Nystrom.
2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling .
4. Door Size: As indicated.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage , factory finished.
6. Frame Material: Same material, thickness, and finish as door .

7. Latch and Lock: Cam latch, screwdriver operated with interior release.

B. Flush Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Karp Associates, Inc.
   b. MIFAB, Inc.
   c. Nystrom.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling .
4. Door Size: As indicated.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage , factory finished.
6. Frame Material: Same material and thickness as door .
7. Latch and Lock: Cam latch, screwdriver operated with interior release.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Exposed Flanges :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Karp Associates, Inc.
   b. MIFAB, Inc.
   c. Nystrom.
2. Description: Door face flush with frame, uninsulated; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling .
4. Door Size: As indicated.
5. Fire-Resistance Rating: Not less than that of adjacent construction .
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch , 20 gage , factory finished.
7. Frame Material: Same material, thickness, and finish as door .
8. Latch and Lock: Self-latching door hardware, operated by key with interior release.

B. Fire-Rated, Flush Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Karp Associates, Inc.
   b. MIFAB, Inc.
   c. Nystrom.
2. Description: Door face flush with frame, uninsulated; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling .
4. Door Size: As indicated.
5. Fire-Resistance Rating: Not less than that of adjacent construction .
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch , 20 gage , factory finished.
7. Frame Material: Same material, thickness, and finish as door .

8. Latch and Lock: Self-closing, self-latching door hardware, operated by key , with interior release.

2.4 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

D. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

F. Aluminum Extrusions: ASTM B221, Alloy 6063.

G. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

H. Frame Anchors: Same material as door face.

I. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical 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.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil for topcoat.
    a. Color: As selected by Architect from full range of industry colors .

E. Stainless Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: ASTM A480/A480M No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.
    a. Run grain of directional finishes with long dimension of each piece.
    b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Bright, Cold-Rolled, Unpolished Finish: ASTM A480/A480M No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates 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. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.
2. Aluminum-framed entrance door systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
2. Include point-to-point wiring diagrams.

C. Delegated Design Submittal: For aluminum-framed entrances and storefronts, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs 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.
2. Delegated Design Engineer: 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.

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 aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
   a. Thermal stresses transferring to building structure.
   b. Glass breakage.
   c. Noise or vibration created by wind and thermal and structural movements.
   d. Loosening or weakening of fasteners, attachments, and other components.
   e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans 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.
   a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

2.2 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. Tubelite Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Framing Construction: Thermally broken.
2. Interior Vestibule Framing Construction: Nonthermal.
3. Glazing System: Retained mechanically with gaskets on four sides.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.3 ENTRANCE DOOR SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. Tubelite Inc.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-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.
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.

2.4 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. Glazing Sealants: As recommended by manufacturer.

2.5 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.

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. 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.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

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 or thicker.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

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. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.2 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. 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 entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

END OF SECTION 084113

SECTION 085473 - VINYL-WOOD COMPOSITE WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes composite-framed windows.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review, discuss, and coordinate the interrelationship of windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for composite windows.

B. Shop Drawings: For composite windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches in size.

D. Samples for Initial Selection: For units with factory-applied finishes.

1. Include Samples of hardware and accessories involving color selection.

E. Samples for Verification: For composite windows and components required, prepared on Samples of size indicated below:

1. Exposed Finishes: 2 by 4 inches.
2. Exposed Hardware: Full-size units.

F. Product Schedule: For composite windows. Use same designations indicated on Drawings.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating composite windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer using workers competent in techniques required by manufacturer for product types and applications indicated with experience on five or more projects of similar size, type, and complexity as this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as indicated on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace composite windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Defects in manufacturing, materials, and workmanship in glass and non-glass parts.
2. Warranty Period:
   a. Window: 10 years from date of purchase and transferrable to Owner on date of Substantial Completion.
   b. Glazing Units: 20 years from date of purchase and transferrable to Owner on date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Andersen Windows, Inc.; 100 Series Fibrex® Material. Provide basis of design product, or comparable product approved by Architect.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

2. Minimum Performance Class: LC.
    a. Windows in Project shall have same performance class.
    b. Performance class indicated for each type of window.
3. Minimum Performance Grade: 40.
    a. Windows in Project shall have same performance grade.

B. Window Type:

1. Horizontal sliding.
2. Fixed.
    a. Material: PVC polymer and reclaimed wood fiber composite with PVC cap-stock.
    b. Performance Class: LC.
    c. Performance Grade: 40.

C. Window Performance:

1. Air Leakage Resistance: 0.3 cfm/sq. ft..
2. Water Penetration: 6.06 lbf/sq. ft..
3. Uniform Deflection Test: 60.15 lbf/sq. ft..
4. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.27 Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of .28.
6. Sound Transmission Class (STC): Rated for not less than 32 STC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E413.
7. Outside-Inside Transmission Class (OITC): Rated for not less than 23 OITC when tested for laboratory sound transmission loss in accordance with ASTM E90 and determined by ASTM E1332.

D. Source Limitations: Obtain composite windows from single source from single manufacturer.

E. Finishes: For frame and sash.

1. Exterior Color: As selected by Architect from manufacturer's full range.
2. Interior Finish: Selected by Architect from manufacturer's full range.

F. Glazing:

1. Glass: Clear annealed glass, ASTM C1036, Type 1, Class 1, q3.
2. Kind: Fully tempered where indicated on Drawings.
3. Float Glass: As required by performance requirements indicated.
    a. Low-E Coating: Sputtered on second surface.
4. Insulating-Glass Units: ASTM E2190.
    a. Glass: ASTM C1036, Type 1, Class 1, q3.
    b. Tint: Clear.
    c. Kind: Fully tempered where indicated on Drawings.
    d. Lites: As indicated on drawings.
    e. Filling: Fill space between glass lites with argon blend.
    f. Low-E Coating: Sputtered on second surface.

G. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

1. Dual Glazing System:
   a. Interior Lite: [Glass] [Insulating-glass unit] <Insert type>.
   b. Exterior Lite: [Glass] [Insulating-glass unit] <Insert type>.

H. Hardware, General: Provide manufacturer's standard hardware fabricated from stainless steel, die-cast zinc, or plastic material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

I. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: Rigid PVC or other weather-resistant plastic track with manufacturer's standard integral color of dimensions and profile indicated; designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
3. Roller and Guide Assemblies: Dual-adjustable, brass-extruded glide track, and low-friction design.

J. Weather Stripping: Provide manufacturer’s standard full-perimeter weather stripping for each operable sash unless otherwise indicated.

K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.3 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Half, outside for sliding sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.
2. Finish for Interior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range to match frame.
3. Finish for Exterior Screens: Baked-on organic coating in color selected by Architect from manufacturer's full range matching color and finish of cladding.

C. Glass-Fiber Mesh Fabric: 17-by-15 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: Charcoal gray.

D. Stainless Steel Wire Fabric: 24-by-24 mesh of 0.00572-inch- diameter, coated stainless steel wire.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Andersen Windows, Inc.; TruScene insect screen or comparable product.
2. Wire-Fabric Finish: Coated, Type 300 series.

2.4 FABRICATION

A. Fabricate composite windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze composite windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, compatible with window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units. Provide manufacturer's standard finish to match window units.

E. Hardware: Mount hardware using screws in composite extrusion frame.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 085473

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Mechanical door hardware for the following:

a. Swinging Doors.

2. Cylinders for door hardware specified in other Sections.
3. Electrified door hardware.

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames" for astragals provided as part of labeled fire-rated assemblies and for door silencers provided as part of hollow-metal frames.
2. Section 081416 "Flush Wood Doors" for astragals provided as part of labeled fire-rated assemblies.
3. Section 084113 "Aluminum-Framed Entrances and Storefronts" for installation of entrance door hardware, including cylinders.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagrams of systems that interface with electrified door hardware.
c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheets and 4-inch-long Samples for other products.

a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying

requirements.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

    a. 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.
    b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    c. Format: Use same scheduling sequence and vertical format and use same door numbers as in the Contract Documents.
    d. Content: Include the following information:

        1) Identification number, location, hand, fire rating, size, and material of each door and frame.
        2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
        3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
        4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
        5) Fastenings and other pertinent information.
        6) Explanation of abbreviations, symbols, and codes contained in schedule.
        7) Mounting locations for door hardware.
        8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Installer, 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.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Provide certification installing commercial hardware from the Installer.

B. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

D. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to be included in maintenance manuals. Include final hardware and keying schedule.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC).

C. Source Limitations: Obtain each type of door hardware from a 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.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.

F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

G. 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.

H. Accessibility Requirements: Comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design, the ABA Standards of the Federal agency having jurisdiction and ICC A117.1 for door hardware on doors in an accessible route.

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. Closers: Adjust door and gate closer sweep periods so that, from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Contractor, and Architect, conference participants shall also include Installer's, Architectural Hardware Consultant/Hardware Supplier and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

J. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up 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 manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner or Contractor by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute 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.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. 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.

F. Door Hardware and Millwork supplier: Contact John Spargo at The Spargo Group to request factory quote for door hardware. Email: jspargo@spargogroup.com and Office PH: 630-516-9092.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures include 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: Two years from date of Substantial Completion, unless otherwise indicated.

   a. Cylindrical Locks: Five years from date of Substantial Completion.
   b. Mortise Locks: Ten years from the date of Substantial Completion.
   c. Exit Devices: Ten years from date of Substantial Completion.
   d. Manual Closers: Ten years from date of Substantial Completion.

1.9 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.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive

maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA designations referenced.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and frames and wood doors.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Best Access.
b. Hager Companies.
c. McKinney Products Company; an ASSA ABLOY Group company.

B. Continuous, Gear-Type Hinges: Extruded-aluminum, pin less, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Best Access.
c. Roton Hinge Company.
d. Select Products Limited.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in the door hardware schedule.

B. Lock Throw: Comply with testing requirements for the length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch latch bolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated on the hardware schedule.
2. Levers: Cast.
    a. "LR" Lever.
3. Escutcheons (Roses): Wrought.
4. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latch bolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

A. Bored Locks: BHMA A156.2; Grade 2 certified 500,000 cycle test; Series 4000.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. DormaKaba USA.
    b. Best Access.

B. Interconnected Locks: BHMA A156.2; Grade 2; Series 4000. Certified 500,000 cycle test.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. DormaKaba USA.
    b. Best Access.

2.4 AUTOMATIC AND MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Architectural Builders Hardware Mfg., Inc.
    b. Don-Jo Mfg., Inc.
    c. Door Controls International, Inc.
    d. Trimco Hardware.

2.5 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3. certified of 2.5 million cycle test and 3000 lbs. static load.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DormaKaba USA.
b. Precision Hardware.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   b. Best Access.
   c. DormaKaba USA.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; interchangeable cores; face finished to match lockset.

2.7 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.
2. Provide temporary keyed alike requested by the contractor for construction use.

B. Keys: Brass.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
   a. Notation: "DO NOT DUPLICATE."
2. Quantity: In addition to one extra key blank for each lock, provide the following:
   a. Cylinder Change Keys: Three.
   b. Master Keys: Five.
   c. Grand Master Keys: Five.
   d. Great-Grand Master Keys: Five.

2.8 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 160 50 percent of the number of locks.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Lund Equipment Co., Inc.
   b. MMF Industries.
   c. TelKee; Oasis International.
2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.9 SURFACE CLOSERS

A. Surface Closers: 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 recommendations 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. Certified of 10 million cycle test.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Best Access.
    b. DormaKaba USA.

2.10 MECHANICAL STOPS AND HOLDERS

A. Wall Stops: BHMA A156.16; stainless steel base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Architectural Builders Hardware Mfg., Inc.
    b. Don-Jo Mfg., Inc.
    c. Trimco Hardware.

2.11 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Architectural Builders Hardware Mfg., Inc.
    b. DormaKaba USA.
    c. Trimco Hardware.

2.12 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. K.N. Crowder.
    b. Legacy LLC
    c. National Guard Products, Inc.
    d. Reese Enterprises, Inc.

2.13 THRESHOLDS

A. Thresholds: 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. K.N. Crowder.

b. Legacy LLC
c. National Guard Products, Inc.
d. Reese Enterprises, Inc.

2.14 ELECTRIC STRIKE

A. Electric Strike: BHMA A156.31; Provide electric strikes designed for use with type of locks shown at each opening. Provide electric strikes UL Listed and burglary resistance that are tested by the ANSI/BHMA and certified for 500,000 cycle test Grade 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DormaKaba USA.
b. Rutherford Controls Inc.

2.15 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Don-Jo Mfg., Inc.
c. Trimco Hardware.

2.16 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Architectural Builders Hardware Mfg., Inc.
b. Don-Jo Mfg., Inc.
c. Trimco Hardware.

2.17 LOW ENERGY DOOR OPERATOR AND POWER ASSIST

A. Door operator: Standard ANSI/BHMA A156.19 and Grade 1 applies only to swing door operators. ANSI/BHMA 156.19 Power Assist and Low Energy Power Operated Doors. UL and CUL listed fire door operators with automatic closers. ICC/ANSI A117.1 Accessible and Usable buildings and facilities. Underwriters Laboratories: ANSI/UL 325 Door, Drapery, Gate, Louver, and Window Operators and Systems. • California State Fire Marshall (CSFM) approved.

B. All low energy doors shall be marked with signage visible from both sides of the door, with the words, “AUTOMATIC CAUTION DOOR”.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Best Access.
b. DormaKaba USA.

2.18 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. 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 BHMA A156.18.

C. 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, except 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. Fire-Rated Applications:
    a. Wood or Machine Screws: For the following:
        1) Hinges are mortised to doors or frame; use threaded-to-head wood screws for wood doors and frames.
        2) Strike plates to frames.
        3) Closers to doors and frames.
    b. Steel Through Bolts: For the following unless door blocking is provided:
        1) Surface hinges to doors.
        2) Closers to doors and frames.
        3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.19 FINISHES

A. Provide finishes complying with 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.

PART – 3 EXECUTIONS

3.1 EXAMINATION

D. 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.

E. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

G. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

H. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

I. 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. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

J. 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. 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 according to industry standards.

K. 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.

L. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

M. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying schedule and directed by Owner.
2. Furnish permanent cores to Contractor for installation.

N. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

O. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."

P. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

Q. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 FIELD QUALITY CONTROL

S. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

T. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

U. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

V. Clean adjacent surfaces soiled by door hardware installation.

W. Clean operating items as necessary to restore proper function and finish.

X. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

Y. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

A. Furnish products as listed in the following hardware sets:

B. Manufacturers, finish and their abbreviations used in the schedule:

ADA	Adams Rite Manufacturing
BES	Best Access Systems
DOR	Dorma Architectural Hardware
KNC	K.N. Crowder
LEG	Legacy Manufacturing
LUN	Lund Key Control Cabinet, Inc.
TRI	Trimco Hardware

335	Satin/Black Anodized
600	Primed Coat
619	Satin Nickel
626	Brass/Satin Chrome
628	Anodized Aluminum
630	Satin Stainless Steel
652	Steel/Satin Chrome
689	Aluminum
693	Black
BLK	Black
BLK	Black Anodized
GRY	Grey
MBK	Matte Black

B4E	Beveled Four Edges
B.S.	Backset
CD	Cylinder Dogging
FHUC	#12-24 X 7/16" Type C Phillips, Flat Head, Undercut Screws
LDW	Less Door Width
MKD	Master Keyed
MLR	Motorized Latch Retraction
MS/ES	Machine Screws/Expansion Shields
MTG.	Mounting
(NL)	Night Latch

NRP	Non-Removable Pin
SMS	Sheet Metal Screws
STK	Strike
T	Temporary Construction Core
T.B.	Toggle Bolt
UMB	Universal Mounting Box
.050	16 Gauge

HARDWARE SET – 1

ALD DOOR NO. 100A

1 EA. ELECTRIFIED CONTINUOUS HINGE A101HD X FHUC 6 WIRES	628 ABH
1 EA. ELECTRIFIED RIM EXIT DEEVICE MLRCD9300T X CYL (NL) FAIL SECURE	630 DOR
1 EA. I.C. RIM CYLINDERS 87R20BLK (TRIM)	630 DOR
1 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. OFFSET PULLS 1191-4 X 1" DIA. X 12" THRU BOLT MTG.	630 TRI
1 EA. DOOR CLOSER 8916 SPA HEAVY DUTY PARALLEL ARM	689 DOR
1 EA. CONCEALED OVERHEAD STOP 910 SERIES STOP	689 DOR
1 EA. HEAVY DUTY BLADE STOP SPACER BSHD (AS REQUIRED)	689 DOR
1 EA. DROP PLATE DP89 (AS REQUIRED)	689 DOR
1 EA. BRUSH DOOR SWEEPS WITH DRIP 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA X MS/ES	628 LEG
1 EA. POWER SUPPLY DKPS 2AMP	----- DOR
1 EA. WIRING DIAGRAM	----- DOR

WEATHERSTRIP PROVIDED BY ALUMINUM STOREFRONT DOOR SUPPLIER.
CONDUIT, WIRING AND ROUGH IN BY ELECTRICIAN.
CARD, KEYFOB, READERS AND DOOR CONTACTS PROVIDED BY SECURITY CONTRACTOR.
DOORS SHALL BE SECURE AT ALL TIMES. WHEN A VALID CREDENTIAL ENABLE THE DEVICE AND ALLOW TO EGRESS.
DEPRESSING THE TOUCH BAR FROM THE INSIDE IT RETRACT THE LATCH BOLT AND ALLOWED TO EGRESS OUT.
IN CASE OF EMERGENCY AND POWER FAILURE THE DOOR REMAIN SECURED.
BY USING THE KEY, UNSECURED THE DOOR AND ALLOWED TO EGRESS.

HARDWARE SET – 2

ALD DOOR NO. 100B

1 EA. CONTINUOUS HINGE A101HD X FHUC	628 ABH
1 EA. RIM EXIT DEEVICE CD9300T X CYL (NL)	630 DOR
1 EA. ELECTRIC STRIKE RCI 0162 FSV 12/24VDC FAIL SECURE	630 DOR
1 EA. I.C. RIM CYLINDERS 87R20BLK (TRIM)	630 DOR
1 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. OFFSET PULLS 1191-4 X 1" DIA. X 12" THRU BOLT MTG.	630 TRI
1 EA. DOOR CLOSER 8916 SDS SPRING ASSIST PARALLEL DEAD STOP ARM	689 DOR
1 EA. HEAVY DUTY BLADE STOP SPACER BSHD (AS REQUIRED)	693 DOR
1 EA. DROP PLATE DP89 (AS REQUIRED)	693 DOR
1 EA. POWER SUPPLY DKPS 2AMP	----- DOR
1 EA. WIRING DIAGRAM	----- DOR

WEATHERSTRIP PROVIDED BY ALUMINUM STOREFRONT DOOR SUPPLIER.

CONDUIT, WIRING AND ROUGH IN BY ELECTRICIAN.
CARD, KEYFOB, READERS AND DOOR CONTACTS PROVIDED BY SECURITY CONTRACTOR.
DOORS SHALL BE SECURE AT ALL TIMES. WHEN A VALID CREDENTIAL ENABLE THE DEVICE AND ALLOW TO EGRESS.
DEPRESSING THE TOUCH BAR FROM THE INSIDE IT RETRACT THE LATCH BOLT AND ALLOWED TO EGRESS OUT.
IN CASE OF EMERGENCY AND POWER FAILURE THE DOOR REMAIN SECURED.
BY USING THE KEY, UNSECURED THE DOOR AND ALLOWED TO EGRESS.

HARDWARE SET – 3

ALD DOOR NO. 128A

1 EA. ELECTRIFIED CONTINUOUS HINGE A101HD X FHUC 6 WIRES	628 ABH
1 EA. ELECTRIFIED RIM EXIT DEVICE MLRCD9300T X CYL (NL) FAIL SECURE	630 DOR
1 EA. I.C. RIM CYLINDERS 87R20BLK (TRIM)	630 DOR
1 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. OFFSET PULLS 1191-4 X 1" DIA. X 12" THRU BOLT MTG.	630 TRI
1 EA. ADA DOOR OPERATOR ED900 J8 TOP JAMB	689 DOR
1 EA. CONCEALED OVERHEAD STOP 910 SERIES STOP	689 DOR
1 EA. BRUSH DOOR SWEEPS WITH DRIP 78918CA	628 LEG
1 EA. RABBETED THRESHOLD 356MA X MS/ES	628 LEG
1 EA. ACTUATOR WALL SWITCH WS-1 X UMB MTG (EXTERIOR)	630 DOR
1 EA. ACTUATOR FRAMES SWITCH FS-1 (VESTIBULE)	630 DOR
1 EA. WIRING DIAGRAM	----- DOR

WEATHERSTRIP PROVIDED BY ALUMINUM STOREFRONT DOOR SUPPLIER.
CONDUIT, WIRING AND ROUGH IN BY ELECTRICIAN.
CARD, KEYFOB, READERS AND DOOR CONTACTS PROVIDED BY SECURITY CONTRACTOR.
DOORS SHALL BE SECURE AT ALL TIMES. WHEN A VALID CREDENTIAL ENABLE THE DEVICE AND ALLOW TO EGRESS.
DEPRESSING THE TOUCH BAR FROM THE INSIDE IT RETRACT THE LATCH BOLT AND ALLOWED TO EGRESS OUT.
IN CASE OF EMERGENCY AND POWER FAILURE THE DOOR REMAIN SECURED.
BY USING THE KEY, UNSECURED THE DOOR AND ALLOWED TO EGRESS.

DOOR OPERATOR: PRESSING THE PUSH BUTTON ON EITHER SIDE, IT WILL OPERATES THE DOOR. OPERATOR HAVE TOGGLE SWITCH ON/OFF BUTTON ON THE SIDE OF THE COVER.

HARDWARE SET – 4

ALD DOOR NO. 128B

1 EA. CONTINUOUS HINGE A101HD X FHUC	628 ABH
1 EA. RIM EXIT DEEVICE CD9300T X CYL (NL)	630 DOR
1 EA. ELECTRIC STRIKE RCI 0162 FSV 12/24VDC FAIL SECURE	630 DOR
1 EA. I.C. RIM CYLINDERS 87R20BLK (TRIM)	630 DOR
1 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. OFFSET PULLS 1191-4 X 1" DIA. X 12" THRU BOLT MTG.	630 TRI
1 EA. ADA DOOR OPERATOR ED900 J8 TOP JAMB	689 DOR
1 EA. ACTUATOR WALL SWITCH WS-1 (VESTIBULE)	630 DOR
1 EA. ACTUATOR FRAMES SWITCH FS-1 (LOBBY)	630 DOR
1 EA. WIRING DIAGRAM	----- DOR

WEATHERSTRIP PROVIDED BY ALUMINUM STOREFRONT DOOR SUPPLIER.
CONDUIT, WIRING AND ROUGH IN BY ELECTRICIAN.
CARD, KEYFOB, READERS AND DOOR CONTACTS PROVIDED BY SECURITY CONTRACTOR.
DOORS SHALL BE SECURE AT ALL TIMES. WHEN A VALID CREDENTIAL ENABLE THE DEVICE AND ALLOW TO EGRESS.
DEPRESSING THE TOUCH BAR FROM THE INSIDE IT RETRACT THE LATCH BOLT AND ALLOWED TO EGRESS OUT.
IN CASE OF EMERGENCY AND POWER FAILURE THE DOOR REMAIN SECURED.
BY USING THE KEY, UNSECURED THE DOOR AND ALLOWED TO EGRESS.

DOOR OPERATOR: PRESSING THE PUSH BUTTON ON EITHER SIDE, IT WILL OPERATES THE DOOR. OPERATOR HAVE TOGGLE SWITCH ON/OFF BUTTON ON THE SIDE OF THE COVER.

HARDWARE SET – 5

PAIR OF DOOR NO. 103A

2 EA. CONTINUOUS HINGE A101HD X FHUC	628 ABH
1 PR. MANUAL FLUSH BOLTS 3917 – 12″ ROD (INACTIVE LEAF)	630 TRI
1 EA. DUST PROOF STRIKE 3911 MS/ES	630 TRI
1 EA. MORTISE EXIT DEVICE CD9500T YR09 (NL) STK (KNURLED AS REQ.)	630 DOR
2 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (TRIM & CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8616 DS PARALLEL DEAD STOP ARM (ACTIVE LEAF)	689 DOR
1 EA. SURFACE OVERHEAD STOPS 900S SERIES STOP (INACTIVE LEAF)	689 DOR
2 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E	630 TRI
1 SET HEAD/JAMB SEALS 5823CA	628 LEG
1 EA. BRUSH DOOR SWEEPS WITH DRIP 78918BK	BLK LEG
1 EA. RABBETED THRESHOLD 356BK X MS/ES	BLK LEG

ASTRAGAL PROVIDED BY HOLLOW METAL DOOR SUPPLIER.

HARDWARE SET – 6

DOOR NO. 113A, 117A

1 EA. CONTINUOUS HINGE A101HD X FHUC	628 ABH
1 EA. RIM EXIT DEVICE CD9300 YR09 (NL) STK	630 DOR
2 EA. I.C. MORTISE CYLINDERS 97X10BLK138 (TRIM & CYLINDER DOGGING)	630 DOR
2 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8916 SPA HEAVY DUTY PARALLEL ARM	689 DOR
1 EA. DOOR CLOSER 8916 DS PARALLEL DEAD STOP ARM (DR. 117A)	689 DOR
1 EA. WALL STOP 1270CX	630 TRI
1 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E	630 TRI
1 SET HEAD/JAMB SEALS 5823CA	628 LEG
1 EA. BRUSH DOOR SWEEPS WITH DRIP 78918BK	BLK LEG
1 EA. RABBETED THRESHOLD 356BK X MS/ES	BLK LEG

HARDWARE SET – 7

DOOR NO. 130A

1 EA. CONTINUOUS HINGE A101HD X FHUC	628 ABH
1 EA. STOREROOM LOCK C280T LRE 2-3/4" B.S. STK	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. LATCH PROTECTOR 5002 – 6" X 4" 13 GAUGE	630 TRI
1 EA. DOOR CLOSER 8616 DS PARALLEL DEAD STOP ARM	689 DOR
1 EA. KICK PLATES K0050 – 10" X 2" LDW .050 B4E	630 TRI
1 SET HEAD/JAMB SEALS 5823CA	628 LEG
1 EA. BRUSH DOOR SWEEPS WITH DRIP 78918BK	BLK LEG
1 EA. RABBETED THRESHOLD 356BK X MS/ES	BLK LEG

HARDWARE SET – 8

DOOR NO. 102A

3 EA. HINGES FBB179 4.5" X 4.5"	652 BES
1 EA. CLASSROOM LOCK C270T LRE 2-3/4" B.S. STK	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. LATCH PROTECTOR 5002 – 6" X 4" 13 GAUGE	630 TRI
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10" X 2" LDW .050 B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG

HARDWARE SET – 9

DOOR NO. 113B, 117B, 213A, 217A, 313A, 317A, 413A, 417A

3 EA. HINGES FBB179 4.5" X 4.5"	652 STA
1 EA. RIM EXIT DEVICE (PASSAGE) F9300 X YR23 X 463 STK	630 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATE J102 – 10" X 2" LDW X .050 X SMS X B4E	630 HIA
1 SET HEAD/JAMB SEALS 5881SB	BLK LEG
1 EA. DOOR SWEEPS 7923CA X SMS (AS REQUIRED)	628 LEG

HARDWARE SET – 10

DOOR NO. 119A, 120A

3 EA. HINGES FBB179 4.5" X 4.5"	652 STA
1 EA. STOREROOM LOCK C280T LRE 2-3/4" B.S. STK	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. DOOR CLOSER 8616 AF86P PARALLEL ARM (DR. 120A)	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10" X 2" LDW .050 B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG

HARDWARE SET – 11

DOOR NO. 121A, 222A, 322A, 422A

3 EA. HINGES FBB179 4.5″ X 4.5″	652 STA
1 EA. PASSAGE SET C210T LRE 2-3/4″ B.S. STK	626 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG
1 EA. DOOR SWEEPS 7923CA (AS REQUIRED)	628 LEG

HARDWARE SET – 12

PAIR OF DOOR NO. 121B

6 EA. HINGES FBB179 4.5″ X 4.5″	652 BES
1 PR. MANUAL FLUSH BOLTS 3917 – 12: ROD (INACTIVE LEAF)	626 TRI
1 EA. DUST PROOF STRIKE 3911ES	626 TRI
1 EA. CYLINDRICAL STOREROOM LOCK C280T LRE 2-3/4″ B.S. STK (ACTIVE LEAF)	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8616 DS PARALLEL DEAD STOP ARM (ACTIVE LEAF)	689 DOR
1 EA. SURFACE OVERHEAD STOP 900S SERIES (INACTIVE LEAF)	689 DOR
2 EA. KICK PLATES K0050-10″ X 2″ LDW X .050 X B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG
2 EA. DOOR SWEEPS 7923CA (AS REQUIRED)	628 LEG

ASTRAGAL PROVIDED BY HOLLOW METAL DOOR SUPPLIER.

HARDWARE SET – 13

DOOR NO. 122A, 123A

3 EA. HINGES FBB179 4.5″ X 4.5″	652 BES
1 EA. COIN & THUMB TURN WITH INDICATOR DB171 2-3/4″ B.S. STK	626 DOR
1 EA. PASSAGE SET C210T LRE 2-3/4″ B.S. STK	626 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG

HARDWARE SET – 14

DOOR NO. 124A, 126A, 127A

1 EA. OFFICE LOCK C250T LRE 2-3/4″ B.S. STK	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E (DR. 124A)	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG

HARDWARE SET – 15

DOOR NO. 218A, 219A, 220A, 318A, 319A, 320A, 418A, 419A, 420A

3 EA. HINGES FBB179 4.5″ X 4.5″	652 STA
1 EA. STOREROOM LOCK C280T LRE 2-3/4″ B.S. STK (KNURLED AS REQUIRED)	626 DOR
1 EA. PERMANENT CORES 77XX 6 OR 7 PIN MKD	626 DOR
1 EA. DOOR CLOSER 8616 AF86 REGULAR ARM	689 DOR
1 EA. WALL STOP 1270WV	630 TRI
1 EA. KICK PLATES K0050 – 10″ X 2″ LDW .050 B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG
1 EA. DOOR SWEEPS 7923CA (AS REQUIRED)	628 LEG

RESIDENT UNITS

HARDWARE SET – 16

DOOR NO. 1

2 EA SPRING HINGES 2060R 4.5″ X 4.5″	652 BES
1 EA. HINGES FBB179 4.5″ X 4.5″	652 BES
1 EA. INTERCONNECTED LOCK J310T LRB X 2-3/4″ B.S. STK	626 DOR
1 EA. DOOR KNOCKER WITH VIEWER 625V-976U 200 DEGREE	626 TRI
1 EA. DOOR VIEWER 976U 200 DEGREE (REQUIRED FOR ADA UNITS)	626 TRI
1 EA. BASE STOP 1208	626 TRI
2 EA. HEAVY DUTY HINGE PIN STOP1240 (AS REQUIRED)	626 TRI
1 EA. KICK PLATES K0050-8″ X 2″ LDW X .050 X B4E	630 TRI
1 SET RATED HEAD/JAMB SEALS 5881SB	BLK LEG
1 EA. DOOR SWEEPS 7923CA (AS REQUIRED)	628 LEG

PROVIDE 2 DOOR VIEWER FOR ADA UNITS.

HARDWARE SET – 17

DOOR NO. 2, 3

3 EA. RADIUS HINGE RD741BA-1/4″ 3.5″ X 3.5″	626 BES
1 EA. PRIVACY LOCKS C340 LRB X 2-3/4 B.S.	626 DOR
1 EA. BASE STOP 1208	630 TRI
2 EA. HEAVY DUTY HINGE PIN STOP 1240 (AS REQUIRED)	626 TRI

SILENCERS PROVIDED BY KNOCK DOWN FRAMES MANUFACTURER.

HARDWARE SET – 18

DOOR NO. 4

3 EA. RADIUS HINGE RD741BA-1/4″ 3.5″ X 3.5″	626 BES
1 EA. DEADBOLT CYLINDER WITH BLANK PLATE DB161T 2-3/4″ STK	626 DOR
1 EA. DOOR PULLS APC11 ½″ DIAMETER 6″ CTC THRU BOLT MTG.	626 TRI
1 EA. BASE STOP 1208	630 TRI
2 EA. HEAVY DUTY HINGE PIN STOP 1240 (AS REQUIRED)	626 TRI

SILENCERS PROVIDED BY KNOCK DOWN FRAMES MANUFACTURER.

HARDWARE SET – 19

DOOR NO. 5, 6, 7, 8, 10

3 EA. RADIUS HINGE RD741BA-1/4" 3.5" X 3.5"	626 BES
1 EA. DUMMY LEVER TRIM C301 LRB	626 DOR
1 EA. BALL CATCH 1555 STK	626 TRI
1 EA. BASE STOP 1208	630 TRI
2 EA. HEAVY DUTY HINGE PIN STOP 1240 (AS REQUIRED)	626 TRI

SILENCERS PROVIDED BY KNOCK DOWN FRAMES MANUFACTURER.

HARDWARE SET - 20

PAIR OF DOOR NO. 9, 11

6 EA. RADIUS HINGE RD741BA-1/4" 3.5" X 3.5"	626 BES
2 EA. DUMMY LEVER TRIM C301 LRB	626 DOR
2 EA. BALL CATCH 1555 STK	626 TRI
2 EA. BASE STOP 1208	630 TRI
4 EA. HEAVY DUTY HINGE PIN STOP 1240 (AS REQUIRED)	626 TRI

SILENCERS PROVIDED BY KNOCK DOWN FRAMES MANUFACTURER.

HARDWARE SET – 21

MISCELLENOUS

1 EA. KEY CONTROL WALL CABINET 1201-3 – 120 CAPACITIES TO NO EXPANSION TWO TAG KEY SYSTEM	Gry LUN

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Glass for windows.
2. Glazing sealants and accessories.

1.2 RELATED SECTIONS

A. 081113 Section “Hollow Metal Doors and Frames” for glazing in hollow metal doors.

B. See Master Finish Schedule for additional information.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

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

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 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 (4.4 deg C).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
1. PPG's Solarban 60 Solar Control low-E Glass
2. Transmittance
   a. Ultraviolet 18%
   b. Visible 70%
   c. Total Solar Energy 34%
3. Reflectance
   a. Visible Light 11%
   b. Total Solar Energy - 28%
4. U-Value (Imperial)
   a. Winter Nighttime .29
   b. Summer Daytime.
5. Shading Coefficient SC 0.45
6. Solar Heat Gain Coefficient .39
7. Light to Solar Heat Gain1.79

B. Alternate Product for replacement windows with historical significance: Cardinal Insulated Glass (6 mm/13.0/6mm) with the following characteristics:
1. Match PPG's Solarban 60 Solar Control low-E Glass.
2. Or as approved by Architect in writing prior to bid date.

C. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

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 the following: 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. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.

    a. Wind Design Data: As indicated on Drawings.

3. 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 (25 mm), whichever is less.

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. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

B. Safety Glazing: Clear Tempered with polished edges: ASTM C1048. CPSC 16 CFR 1201 Category II. (Shower Doors)

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: Match Architect's samples.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.7 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Push-in Gasket at Shower Doors: EPDM gasket recommended by shower door hardware supplier. (Used to shed water away from glass).

2.8 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 (67 deg C), ambient; 180 deg F (100 deg C), 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. Grind smooth and polish exposed glass edges and corners.

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. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

G. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

H. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

I. 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 by gasket manufacturer.

3.4 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.5 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

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.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Silvered flat glass mirrors.
2. Backlit mirrors.

B. Related Requirements:

1. Section 08 80 00 "Glazing" for glass with reflective coatings used for vision and spandrel lites.
2. Section 10 28 00 "Toilet, Bath, and Laundry Accessories" for metal-framed mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors: Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of mirror and mirror mastic.

B. Preconstruction Test Reports: From mirror manufacturer indicating that mirror mastic was tested for compatibility and adhesion with mirror backing and substrates on which mirrors are installed.

C. Sample Warranty: For special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified Installer, who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Mirror Mastic Compatibility Test: Submit mirror mastic products to mirror manufacturer for testing to determine compatibility of mastic with mirror backing.

1. Testing is not required if data are submitted based on previous testing of mirror mastic products and mirror backing matching those submitted.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Mirrors: Obtain each mirror type from single source from single manufacturer.

B. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.

B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.

1. Nominal Thickness: As recommended by manufacturer for mirror size indicated.

C. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

1. Nominal Thickness: As recommended by manufacturer for mirror size indicated.

D. Safety Glazing Products: For film-backed, laminated or tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.3 BACKLIT MIRRORS

A. Basis of Design Manufacturer: Elio Look Outer Etched Integrated LED Backlit Mirror by ITC Incorporated, 3030 Corporate Grove Dr, Hudsonville, MI 49426, 616-396-1355, Fax: 616-396-1152, Web: www.itc-us.com.com, Email: sales@itc-us.com. Provide basis of design product, or comparable product approved by Architect.

1. Basis of Design Model: Model: 69455.ELS.2448.30K-3P120
   a. Dimensions: 23.6 inch x 47.2" x 1.8"
   b. Housing: Anodized Aluminum.
   c. Lens: Glass
   d. Wattage and Voltage: 27W; 120V AC.
   e. Lumens: 2655 lm
   f. Kelvin: 3000K
   g. Beam Angle: 120 degrees
   h. CRI: 90 minimum

2.4 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

D. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.5 MIRROR HARDWARE

A. Fasteners: Manufacturer's recommended mounting hardware for edge light mirrors.

B. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.6 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. NGA Publications: “Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mastic. Use mirror hardware for edge light mirrors. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Install mastic as follows:
   a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
   b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
   c. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 088300

SECTION 092226 - SUSPENSION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preengineered grid suspension systems for interior gypsum board ceilings and soffits.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for installation and surface preparation of gypsum board assemblies.
2. Section 095123 "Acoustical Tile Ceilings" for ceilings consisting of mineral-base acoustical tiles used with fully concealed suspension systems, stapling, or adhesive bonding.

C. Products furnished, but not installed, under this Section, include anchors, clips, and other suspension system attachment devices to be cast in concrete.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. 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. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items, including the following:
    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.

f. Access panels.
g. Perimeter moldings.

7. Minimum Drawing Scale: 1/8 inch = 1 ft. .

B. Evaluation Reports: For suspension system and anchor and fastener type, from ICC-ES.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace suspension system components that fail in materials within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of metals, metal finishes, and other materials beyond normal use including 50 percent or greater red rust.
2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design components.

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 SUSPENSION SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong Ceiling & Wall Solutions; DRYWALL Interior and Soffit Grid System Flat Ceilings SimpleCurve DRYWALL Grid System or comparable product by one of the following:

1. Certain Teed Corporation.
2. USG Corporation.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C645/C645M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide hot-dip galvanized, G90 coating designation tested and classified for "severe environment performance" in accordance with ASTM C653/C653M.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; electrolytically zinc coated or hot-dip galvanized, G40 coating designation; with minimum 1-1/2-inch- wide knurled mounting flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Butt-edge type.
3. Face Design: Flat, flush.
4. Wall Angle: Angle-shaped profile with each leg not less than 1-1/4 inch.

2.4 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.
   a. Type: Postinstalled expansion or Postinstalled bonded anchors.
   b. Corrosion Protection: Carbon-steel components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.
   c. Corrosion Protection: Stainless steel components complying with ASTM F593 and ASTM F594, Group 1, Alloy 304 or 316.
   d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B164 for UNS No. N04400 alloy.
2. 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 hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing in accordance with ASTM E1190, conducted by a qualified testing and inspecting agency.

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. Stainless Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
3. Nickel-Copper-Alloy Wire: ASTM B164, nickel-copper-alloy UNS No. N04400.
4. 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. Flat Ceiling Hangers Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, 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 PREPARATION

A. Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below thickness that is required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION

A. Installation Standards: ASTM C754 and ASTM C841 and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated suspension systems in accordance with tested fire-rated design.

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 and, if permitted with fire-resistance-rated ceilings, 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. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. 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.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. 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.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to suspension system 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 ceiling soffit area.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

1. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

F. Install bracing at terminations in assemblies.

G. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

H. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

I. Bracing: Sway-brace suspension systems with hangers used for support .

J. Attach perimeter wall angle where suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall angle.

3.4 ERECTION TOLERANCES

A. Install suspension system main and cross runners level to a tolerance of 1/8 inch in 12 ft. , non-cumulative.

B. Install moldings and trim to substrate and level with suspension system to a tolerance of 1/8 inch in 12 ft., non-cumulative.

END OF SECTION 092226

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 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.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, 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, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Wallboard: ASTM C 1396/C 1396M.

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

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

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

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

1. Core: As indicated.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.

1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.

B. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.

1. Core: As indicated.

2. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.

1. Thickness: 1/2 inch.
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. L-Bead: L-shaped; exposed long flange receives joint compound.
c. Expansion (control) joint.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints 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 drying-type, all-purpose compound.

a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose 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.

D. Joint Compound for Tile Backing Panels:

1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. 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. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. L-Bead: Use where indicated.

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 3: Where indicated on Drawings.
4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

5. Level 5: Where indicated on Drawings

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile and porcelain tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Crack isolation membrane.
5. Tile backing panels.
6. Metal edge strips.

B. Related Sections:

1. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 09 29 00 "Gypsum Board" for cementitious backer units.
3. Refer to Master Finish Schedule for product information.

1.2 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products that comply ASTM C 1028 and meet ADA.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Stone thresholds in 6-inch lengths.
4. Metal edge strips in 6-inch lengths.

1.5 QUALITY ASSURANCE

A. Source Limitations for Tile: Obtain tile of each type and color or finish from one 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. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:

1. Stone thresholds.
2. Waterproof membrane.
3. Crack isolation membrane.
4. Joint sealants.
5. Cementitious backer units.
6. Metal edge strips.

D. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with 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.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.7 PROJECT 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 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise 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 TCA 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.

2.2 TILE PRODUCTS

A. Refer to section 09 06 00 “Schedules for Finishes.”

B. Accessories: Provide accessories listed on Master Finish Schedule and all accessories required for a complete installation.

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Granite Thresholds: ASTM C 615, with polished finish.

1. Description: Match Architect's sample.

C. Marble Thresholds: ASTM C 503, with a minimum abrasion resistance of [10][12] per ASTM C 1353 or ASTM C 241 and with honed finish.

1. Description: Match Architect's sample.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 or ASTM C 1325, in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 1/2 inch .

B. Fiber-Cement Underlayment: ASTM C 1288, in maximum lengths available to minimize end-to-end butt joints.

1. Thickness: 1/2 inch.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Polyethylene Sheet: Polyethylene faced on both sides with fleece webbing; 0.008-inch nominal thickness.

2.7 SETTING MATERIALS

A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.

B. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, composed of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

C. Polymer-Modified Tile Grout: ANSI A118.7.

1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
2. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.

2.9 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Section 079200 "Joint Sealants."

1. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.

E. Chemical-Resistant Sealants: For chemical-resistant floors, provide chemical-resistant elastomeric sealant of type recommended and produced by chemical-resistant mortar and grout manufacturer for type of application indicated, with proven service record and compatibility with tile and other setting materials, and with chemical resistance equivalent to mortar/grout.

2.10 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

C. Temporary Protective Coating: Either product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; compatible with tile, mortar, and grout products; and easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F per ASTM D 87.
2. Grout release in form of manufacturer's standard proprietary liquid coating that is specially formulated and recommended for use as temporary protective coating for tile.

D. 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.

E. Grout Sealer: Manufacturer's standard [silicone] product for sealing grout joints and that does not change color or appearance of grout.

2.11 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of 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 or thin-set 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. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. 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.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. 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.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. 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 the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. 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.

E. Joint width: Refer to Master Finish Schedule for specific joint widths. Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch .
2. Quarry Tile: 1/4 inch .
3. Paver Tile: 1/4 inch .
4. Glazed Wall Tile: 1/16 inch .
5. Decorative Thin Wall Tile: 1/16 inch .

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).
2. Do not extend crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on crack isolation membrane with elastomeric sealant.

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated. See drawings and Master Finish Schedule for additional locations.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 TILE BACKING PANEL INSTALLATION

A. Install cementitious backer units and fiber-cement underlayment and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.6 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.7 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove latex-portland cement grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. 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.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.8 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Tile Installation F113: Thin-set mortar; TCA F113.

   a. Tile Type:
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Polymer-modified unsanded grout.

B. Interior Wall Installations, Masonry or Concrete:

1. Tile Installation W202: Thin-set mortar; TCA W202.

   a. Tile Type: Refer to Master Finish Schedule.
   b. Thin-Set Mortar: Latex- portland cement mortar.
   c. Grout: Polymer-modified unsanded grout.

C. Interior Wall Installations, Metal Studs or Furring:

1. Tile Installation W244: Thin-set mortar on cementitious backer units or fiber cement underlayment over cleavage membrane; TCA W244.

   a. Tile Type: Refer to Master Finish Schedule.
   b. Thin-Set Mortar: Latex-portland cement mortar.
   c. Grout: Polymer-modified unsanded grout.

D. Shower Receptor and Wall Installations, Metal Studs or Furring:

1. Tile Installation B415: Thin-set mortar on cementitious backer units or fiber cement underlayment; TCA B415.

a. Tile Type: Refer to Master Finish Schedule.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: Polymer-modified unsanded grout.

END OF SECTION 093000

SECTION 095123 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical tiles for ceilings.

B. Related Requirements:

1. Section 064600 “Wood Trim” for wood trim moldings.

2. Section 083113 “Access Doors and Frames” for access panels that may normally be specified in this section.

C. 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 Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
2. Exposed Moldings and Trim: Set of 6-inch-long Samples of each type and color.

1.3 INFORMATIONAL SUBMITTALS

A. 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. Ceiling suspension-system members.
2. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Size and location of initial access modules for acoustical tile.
4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
5. Minimum Drawing Scale: 1/4 inch = 1 foot.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each concealed grid and exposed component equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.

B. 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 mockup of typical ceiling area as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ACOUSTICAL TILES, GENERAL

A. Source Limitations:

1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system from single source from single manufacturer.

C. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.

D. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL TILES

A. AT:
1. Basis of Design: Armstrong Cirrus High NRC Item No. 556
   a. 15/16” Angled Tegular Tile: 24 x 24 x 7/8 inch
   b. Suspension System: 15/16 inch Prelude

B. AT-2:
1. Basis of Design: USG Radar Basic Item No. 2110
   a. Square Edge Tile: 24 x 24 x 5/8 inch
   b. Suspension System: 15/16 inch Prelude

C. AT-3:
   1. Basis of Design: Armstrong Kitchen Zone Item No. 672
      a. Square Edge Tile: 24 x 48 x 5/8 inch
      b. Suspension System: 15/16 inch Prelude XL

D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

   1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

      a. Type: Postinstalled expansion anchors.
      b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC 1 service condition.
      c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.

   2. 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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

2.5 METAL SUSPENSION SYSTEM

A. Basis of Design: Armstrong’s 15/16” Prelude.

2.6 METAL EDGE MOLDINGS AND WOOD TRIM

A. Refer to Master Finish Schedule for 'Basis of Design' products.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

2.8 MISCELLANEOUS MATERIALS

A. Provide all miscellaneous materials and accessories required to provide a complete installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 CLEANING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095123

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl base.
2. Vinyl molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Coordinate mockups in this Section with mockups specified in other Sections.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.5 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F , in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F .

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Products: Refer to section 09 06 00 "Schedules for Finishes."

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).

1. Group: I (solid, homogeneous) or II (layered).
2. Style and Location:
   a. Style B, Cove: As indicated in drawings.
   b. Millwork Style: In profiles and locations indicated in drawings.

C. Minimum Thickness: 0.125 inch or as indicated by style designation for millwork profiles.

D. Height: As indicated on Drawings.

E. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.

F. Outside Corners: Job formed or preformed.

G. Inside Corners: Job formed or preformed.

H. Colors and Patterns: Match Architect's sample .

2.2 VINYL MOLDING ACCESSORY

A. Products: Refer to section 09 06 00 "Schedules for Finishes."

B. Description: Vinyl nosing for carpet nosing for resilient floor covering reducer strip for resilient floor covering joiner for tile and carpet transition strips .

C. Profile and Dimensions: As indicated .

D. Locations: Provide vinyl molding accessories in areas indicated .

E. Colors and Patterns: Match Architect's sample .

2.3 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 Insert value> g/L or less.

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 resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces 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 manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by 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 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 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 F 1869. 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 F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

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

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.
   a. Miter or cope corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:

1. Tightly adhere to substrates throughout length of each piece.
2. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coats.

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vinyl sheet flooring.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.

D. Product Schedule: For resilient sheet flooring.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.7 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F in spaces to receive resilient sheet flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOORING WITH BACKING

A. Refer to section 09 06 00 “Schedules for Finishes.”

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring 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 resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

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 resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring 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 10 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring 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/1000 sq. ft. 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.

D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply three coat(s).

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl floor tile.
2. Rubber floor tile.
3. Vinyl composition floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and pattern specified.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 LUXURY VINYL FLOOR TILE

A. Products: Refer to section 09 06 00 “Schedules for Finishes.”

B. Tile Standard: ASTM F 1700.

1. Class: As indicated by product designations.
2. Type: As indicated by product designations.

C. Underlayment: Manufacturer’s recommended acoustical flooring underlayment designed to reduce sound transmission.

1. Location: Second story areas.

2.3 RUBBER FLOOR TILE

A. Products: Refer to section 09 06 00 “Schedules for Finishes.”

B. Tile Standard: ASTM F 1344, Class I-A, Homogeneous Rubber Tile.

C. Hardness: Manufacturer's standard hardness, measured using Shore, Type A durometer according to ASTM D 2240.

2.4 VINYL COMPOSITION FLOOR TILE

A. Products: Refer to Master Finish Schedule.

B. Tile Standard: ASTM F 1066, Class 2.

2.5 INSTALLATION MATERIALS

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. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.1 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 10 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft.] [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 F 1869. 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 F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

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.

D. Do not install floor tiles until materials are the same temperature as 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. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.2 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

1. Lay tiles in pattern of colors and sizes indicated.

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

H. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Joint Sealant: Apply sealant to resilient floor tile perimeter and around columns, at door frames, and at other joints and penetrations.

E. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes multi-level pattern loop modular carpet tile.

B. Related Requirements:
1. Section 09 65 13 "Resilient Base" for resilient wall base and accessories installed with 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 installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 2 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

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 occupancy levels 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 by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

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, more than 10 percent edge raveling, snags, runs, [dimensional stability,] [excess static discharge,] [loss of tuft bind strength,] loss of face fiber, <Insert failure characteristic> and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with requirements,

1. Refer to section 09 06 00 “Schedules for Finishes.”

B. Applied Soil-Resistance Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Metal Edge/Transition Strips: Extruded aluminum with [mill] <Insert finish> 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. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

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

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

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

3.3 INSTALLATION

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

B. Installation Method: As recommended in writing by carpet tile manufacturer.

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

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove yarns that protrude from carpet tile surface.
2. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 096816 - SHEET CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Tufted carpet.
2. Woven carpet.

B. Related Requirements:
1. Master Finish Schedule for resilient wall base and accessories installed with carpet.

1.2 ACTION SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Locations where dye lot changes occur.
4. Seam locations, types, and methods.
5. Type of subfloor.
6. Type of installation.
7. Pattern type, repeat size, location, direction, and starting point.
8. Pile direction.
9. Type, color, and location of insets and borders.
10. Type, color, and location of edge, transition, and other accessory strips.
11. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet: 12-inch-square Sample.
2. Carpet Seam: 6-inch Sample.

D. Product Schedule: For carpet. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For carpet, for tests performed by a qualified testing agency.

B. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TUFTED CARPET

A. Refer to section 09 06 00 “Schedules for Finishes.”

2.2 WOVEN CARPET

A. Refer to section 09 06 00 “Schedules for Finishes.”

2.3 INSTALLATION ACCESSORIES

A. Provide all accessories and materials required for a complete installation.

B. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.

C. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.

1. Use adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesives that comply with the product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Seam Adhesive: Hot-melt adhesive tape or similar product recommended by carpet manufacturer for sealing and taping seams and butting cut edges at backing to form secure seams and to prevent pile loss at seams.

E. Metal Edge/Transition Strips: (See Master Finish Schedule for specific information) 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 performance. Examine carpet for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness

characteristics by performing bond and moisture tests recommended by carpet manufacturer.
2. Subfloor finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" for slabs receiving carpet.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 06 10 00 "Rough Carpentry."
2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.

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

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.

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

3.3 INSTALLATION

A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:

1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
2. Preapplied Adhesive Installation: Comply with CRI 104, Section 11.4, "Pre-Applied Adhesive Systems (Peel and Stick)."
3. Hook-and-Loop Installation: Comply with CRI 104, Section 11.5, "Hook and Loop Technology."
4. Stretch-in Installation: Comply with CRI 104, Section 12, "Stretch-in Installations."
5. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.

B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.

C. Do not bridge building expansion joints with carpet.

D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.

E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

3.4 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing carpet:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
2. Remove yarns that protrude from carpet surface.
3. Vacuum carpet using commercial machine with face-beater element.

B. Protect installed carpet to comply with CRI 104, Section 16,"Protecting Indoor Installations."

C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Steel.
2. Galvanized metal.
3. Wood.
4. Clear coat steel.
5. Plastic trim fabrications
6. Pavement Marking Paint.

B. Related Requirements:

1. Section 09 91 23 "Interior Painting" for surface preparation and the application of paint systems on interior substrates.
2. Section 09 96 00 “High-performance Coatings” for coatings on balcony steel.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1.4 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 (7 deg C).

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 (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. 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 manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Provide materials that comply with VOC limits of authorities having jurisdiction.

D. Colors: Match Architect's samples.

2.2 PRIMERS/SEALERS

A. Primer, Bonding, Water Based: MPI #17.

B. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.

2.3 METAL PRIMERS

A. Primer, Galvanized: As recommended in writing by topcoat manufacturer.

2.4 WOOD PRIMERS

A. Primer, Alkyd for Exterior Wood: MPI #5.

2.5 WATER-BASED PAINTS

A. Latex, Exterior Flat (Gloss Level 1): MPI #10.

B. Latex, Exterior Semi-Gloss (Gloss Level 5): MPI #11.

C. Latex, Exterior, Gloss (Gloss Level 6: MPI #119.

2.6 CLEAR SEALER FOR STEEL

A. Exterior Satin Finish – Everbrite Protective Coating with UV Blocker and Anti-Oxidants.

2.7 SOLVENT-BASED PAINTS

A. Alkyd, Exterior Flat (Gloss Level 1): MPI #8.

B. Alkyd, Exterior, Semi-Gloss (Gloss Level 5): MPI #94.

C. Alkyd, Exterior Gloss (Gloss Level 6): MPI #9.

2.8 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Wood: 15 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI 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. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

1. SSPC-SP 2, "Hand Tool Cleaning."

E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

G. Wood Substrates:

1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
2. Sand surfaces that will be exposed to view, and dust off.
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.

H. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Manual."

B. Tint undercoats same color as topcoat, but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. 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.
f. Plastic conduit.

3.4 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. Contractor shall 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 recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

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.

3.6 EXTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Alkyd System:

a. Prime Coat: Primer, alkyd, anticorrosive for metal, MPI #79.
b. Prime Coat: Shop primer specified in Section 051200 "Structural Steel Framing" where substrate is specified.
c. Intermediate Coat: Exterior alkyd enamel matching topcoat.
d. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

B. Galvanized-Metal Substrates:

1. Alkyd System:

a. Prime Coat: Primer, galvanized metal, as recommended in writing by topcoat manufacturer for exterior use on galvanized-metal substrates with topcoat indicated.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Alkyd, exterior, semi-gloss (Gloss Level 5), MPI #94.

C. Wood Substrates: Including wood trim.

1. Latex over Alkyd Primer System:

a. Prime Coat: Primer, alkyd for exterior wood, MPI #5.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.

D. Clear Steel Substrates: Everbrite Protective Coating.

E. Plastic Trim Fabrication Substrates:

1. Latex System:

a. Prime Coat: Primer, bonding, water based, MPI #17.
b. Intermediate Coat: Latex, exterior, matching topcoat.
c. Topcoat: Latex, exterior, low sheen (Gloss Level 3-4), MPI #15.

F. Pavement Marking Paint:

1. Sherwin Williams' Hotline Fast Dry Latex Traffic Marking Paint.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMU).
3. Steel.
4. Wood.
5. Gypsum board.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" for shop priming of metal substrates with primers specified in this Section.
2. Section 09 96 00 "High-Performance Coatings" for high-performance and special-use coatings.
3. Section 09 91 13 "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
4. Section 09 93 00 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

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 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 MANUFACTURERS

A. Refer to section 09 06 00 “Schedules for Finishes.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.

4. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Spray-Textured Ceiling Substrates: Verify that surfaces are dry.

E. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

F. 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 Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

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

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 exceed that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3, "Power Tool Cleaning."

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and 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. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
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

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat 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 in equipment rooms:

    a. Equipment, including panelboards.

2. Paint the following work where exposed in occupied spaces:

    a. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 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. Contractor shall 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 recommendations, Contractor shall pay for testing and apply

additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

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.

3.6 INTERIOR PAINTING SCHEDULE

A. Refer to Master Finish Schedule.

B. Concrete Substrates, Nontraffic Surfaces:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1).
d. Topcoat: Latex, interior, (Gloss Level 2).
e. Topcoat: Latex, interior, (Gloss Level 3).
f. Topcoat: Latex, interior, (Gloss Level 4).
g. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
h. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

C. CMU Substrates:

1. Latex System:

a. Block Filler: Block filler, latex, interior/exterior.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1).
d. Topcoat: Latex, interior, (Gloss Level 2).
e. Topcoat: Latex, interior, (Gloss Level 3).
f. Topcoat: Latex, interior, (Gloss Level 4).
g. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
h. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

2. Alkyd System:

a. Block Filler: Block filler, latex, interior/exterior.
b. Sealer Coat: Primer sealer, latex, interior.
c. Intermediate Coat: Alkyd, interior, matching topcoat.
d. Topcoat: Alkyd, interior, flat (Gloss Level 1).
e. Topcoat: Alkyd, interior, (Gloss Level 3).
f. Topcoat: Alkyd, interior, semi-gloss (Gloss Level 5).
g. Topcoat: Alkyd, interior, gloss (Gloss Level 6).

D. Steel Substrates:

1. Latex over Alkyd Primer System:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal.
b. Prime Coat: Primer, alkyd, quick dry, for metal.
c. Prime Coat: Primer, alkyd, anti-corrosive, for metal or primer, alkyd, quick dry, for metal.
d. Prime Coat: Shop primer specified in Section where substrate is specified.
e. Intermediate Coat: Latex, interior, matching topcoat.
f. Topcoat: Latex, interior, flat, (Gloss Level 1).
g. Topcoat: Latex, interior, (Gloss Level 2).
h. Topcoat: Latex, interior, (Gloss Level 3).
i. Topcoat: Latex, interior, (Gloss Level 4).
j. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
k. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

E. Wood Substrates: Including wood trim, architectural woodwork, and doors.

1. Latex System:

a. Prime Coat: Primer, latex, for interior wood.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1).
d. Topcoat: Latex, interior, (Gloss Level 2).
e. Topcoat: Latex, interior, (Gloss Level 3).
f. Topcoat: Latex, interior, (Gloss Level 4).
g. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
h. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

F. Gypsum Board Substrates:

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior.
b. Prime Coat: Latex, interior, matching topcoat.
c. Intermediate Coat: Latex, interior, matching topcoat.
d. Topcoat: Latex, interior, flat, (Gloss Level 1).
e. Topcoat: Latex, interior, (Gloss Level 2).
f. Topcoat: Latex, interior, (Gloss Level 3).
g. Topcoat: Latex, interior, (Gloss Level 4).
h. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).

i. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

G. Pipe and duct coverings.

1. Latex System:

a. Prime Coat: Primer sealer, latex, interior.
b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, flat, (Gloss Level 1).
d. Topcoat: Latex, interior, (Gloss Level 2).
e. Topcoat: Latex, interior, (Gloss Level 3).
f. Topcoat: Latex, interior, (Gloss Level 4).
g. Topcoat: Latex, interior, semi-gloss, (Gloss Level 5).
h. Topcoat: Latex, interior, gloss, (Gloss Level 6, except minimum gloss of 65 units at 60 degrees).

2. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Primer sealer, latex, interior.
b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1).
d. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 2).
e. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3).
f. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (Gloss Level 5).

3. Alkyd over Latex Primer System:

a. Prime Coat: Primer sealer, latex, interior.
b. Intermediate Coat: Alkyd, interior, matching topcoat.
c. Topcoat: Alkyd, interior, flat (Gloss Level 1).
d. Topcoat: Alkyd, interior, (Gloss Level 3).
e. Topcoat: Alkyd, interior, semi-gloss (Gloss Level 5).
f. Topcoat: Alkyd, interior, gloss (Gloss Level 6).

4. Aluminum Paint System:

a. Prime Coat: Primer sealer, latex, interior.
b. Intermediate Coat: Aluminum paint.
c. Topcoat: Aluminum paint.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes surface preparation and application of wood finishes on the following substrates:

1. Interior Substrates:

a. Dressed lumber (finish carpentry).

B. Related Requirements:

1. Section 09 91 13 "Exterior Painting" for standard paint systems on exterior substrates.
2. Section 09 91 23 "Interior Painting" for stains and transparent finishes on concrete floors.
3. Section 09 96 00 "High-Performance Coatings" for transparent high-performance coatings on concrete floors and clay masonry.

1.2 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of finish system and in each color and gloss of finish indicated.

1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.
2. Label each Sample for location and application area.

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 finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F .

B. Do not apply finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

C. Do not apply exterior finishes in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Refer to section 09 06 00 “Schedules for Finishes.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.

C. Maximum Moisture Content of Interior Wood Substrates: [15][13][10][9] percent, when measured with an electronic moisture meter.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with finish application only after unsatisfactory conditions have been corrected.

1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

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

C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

D. Interior Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
3. Sand surfaces that will be exposed to view and dust off.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

3.3 APPLICATION

A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for finish and substrate indicated.
2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

3.5 INTERIOR WOOD-FINISH-SYSTEM SCHEDULE

A. Refer to Master Finish Schedule

B. Wood substrates, nontraffic surfaces, including wood trim and architectural woodwork.

1. Solid-Color Latex Stain System:

   a. Intermediate Coat: Stain, exterior, water based, solid hide, matching topcoat.
   b. Topcoat: Stain, exterior, water based, solid hide.

2. Moisture-Cured Clear Polyurethane over Stain System:

   a. Stain Coat: Stain, semi-transparent, for interior wood.
   b. First Intermediate Coat: Moisture-cured polyurethane matching topcoat.
   c. Second Intermediate Coat: Moisture-cured polyurethane matching topcoat.
   d. Topcoat: Varnish, polyurethane, moisture-cured, gloss (Gloss Level 6).

END OF SECTION 099300

SECTION 101423 - PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Panel signs.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples: For each exposed product and for each color and texture specified.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.

B. Thermal Movements: For exterior signs, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces.

C. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

2.2 PANEL SIGNS

A. Panel Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ACE Sign Systems, Inc.
   b. Clarke Systems.
   c. Vista System, LLC.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic or phenolic backing sheet to produce composite sheet.
   a. Surface-Applied, Raised Graphics: Applied polymer characters and Braille .
3. Sign-Panel Perimeter: Finish edges smooth.
   a. Edge Condition at Vertical Edges and Horizontal Edges] : Square cut .
   b. Corner Condition in Elevation: Square.
4. Mounting: two-face tape.
5. Surface Finish and Applied Graphics:
   a. Integral Sheet Color: As selected by Architect from full range of industry colors.

2.3 PANEL-SIGN MATERIALS

A. Acrylic Sheet: ASTM D 4802, Type UVF (UV filtering).

2.4 ACCESSORIES

A. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

B. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.

1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.
2. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
3. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of acrylic sheet.
4. Engraved Plastic Laminate: Engrave through exposed face ply of plastic-laminate sheet to expose contrasting core ply.

C. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

D. Subsurface-Engraved Graphics: Reverse engrave back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

C. Remove temporary protective coverings and strippable films as signs are installed.

END OF SECTION 101423

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Impact-resistant handrails.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of wall and door protection showing locations and extent.

1. Include plans, elevations, sections, and attachment details. Show handrail design and support spacing required to withstand structural loads.

C. Samples: For each exposed product and for each color and texture specified, 12 inches long.

1.3 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.

2.2 IMPACT-RESISTANT HANDRAILS

A. Structural Performance: Handrails, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Uniform load of 50 lbf/ft. applied in any direction.
2. Concentrated load of 200 lbf applied in any direction.
3. Uniform and concentrated loads need not be assumed to act concurrently.

B. Plastic, Impact-Resistant Handrails: Manufacturer's standard assembly consisting of snap-on plastic cover installed over continuous retainer.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Construction Specialties, Inc.
   b. Inpro Corporation.
2. Cover: Minimum 0.078-inch-thick, extruded rigid plastic; in dimensions and profiles indicated on Drawings.
   a. Single Handrail: Cylindrical tube profile cover with continuous retainer; with mounting brackets supporting bottom of rail.
   b. Color and Texture: Refer to Master Finish Schedule.
3. Retainer: Minimum 0.080-inch-thick, one-piece, extruded aluminum.
4. Mounting Bracket: Extended mounting on injection-molded plastic brackets.
5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
6. Accessories: Concealed splices, cushions, and mounting hardware.

2.3 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection product manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

C. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches apart.
3. Adjust end caps as required to ensure tight seams.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Private-use bathroom accessories.
3. Underlavatory guards.

B. Related Requirements:

1. Section 088300 "Mirrors" for silvered flat glass and backlit mirrors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated Design Submittal: For grab bars and shower seats.

1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.3 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. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. 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. Shower Seats: Installed units are able to resist 360 lbf applied in any direction and at any point.

2.2 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser:

1. Basis of Design: Subject to compliance with requirements, provide Surface-Mounted Multi-Roll Toilet Tissue Dispenser B-4288 by Bobrick Washroom Equipment, Inc.. Provide basis of design product, or comparable product approved by Architect.
2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
3. Mounting: Surface mounted.
4. Operation: Noncontrol delivery with theft-resistant spindle.
5. Capacity: Designed for 4-1/2- or 5-1/4-inch diameter tissue rolls.
6. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

B. Paper Towel (Folded) Dispenser:

1. Basis of Design: Subject to compliance with requirements, provide Surface-Mounted Paper Towel Dispenser B-262 by Bobrick Washroom Equipment, Inc.. Provide basis of design product, or comparable product approved by Architect.
2. Mounting: Surface mounted.
3. Minimum Capacity: 400 C-fold or 525 multifold towels.
4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Lockset: Tumbler type.
6. Refill Indicator: Pierced slots at sides or front.

C. Soap Dispenser:

1. Basis of Design: Subject to compliance with requirements, provide Surface-Mounted Soap Dispenser B-2111 by Bobrick Washroom Equipment, Inc.. Provide basis of design product, or comparable product approved by Architect.
2. Description: Designed for manual operation and dispensing soap in liquid or lotion form.
3. Mounting: Vertically oriented, surface mounted.
4. Capacity: 40 fl. Oz.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
6. Access: Locked, hinged stainless steel lid for top filling.
7. Refill Indicator: Window type.

D. Grab Bar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ASI Group.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
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. Outside Diameter: 1-1/4 inches or 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

2.3 PRIVATE-USE BATHROOM ACCESSORIES

A. Source Limitations: Obtain each type of private-use bathroom accessory from single source from single manufacturer.

B. See also, Plumbing Fixture Schedule for accessible shower and bath units supplied with accessories including, but not limited to, grab bars, shower curtain rods, soap dish, folding shower seat, etc.

C. Private-Use Toilet Tissue Dispenser:

1. Basis of Design: Subject to compliance with requirements, provide Basco model 511. Provide basis of design product, or comparable product approved by Architect.
2. Description: Single-roll dispenser.
3. Mounting: Surface mounted.
4. Capacity: Designed for 4-1/2- or 5-inch- diameter tissue rolls.
5. Material and Finish: Polished chrome-plated zinc alloy (zamac).

D. Private-Use Shower Curtain Rod:

1. Basis of Design: Subject to compliance with requirements, provide Basco model 1212. Provide basis of design product, or comparable product approved by Architect.
2. Description: 1-inch- 1-1/4-inch outside diameter, straight rod.
3. Configuration: As indicated on Drawings.
4. Mounting Flanges: Designed for concealed fastening, in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 7 finish (polished).
6. Features: Integral chrome-plated brass glide hooks.

E. Private-Use Folding Shower Seat:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ASI Group.
   b. Bobrick Washroom Equipment, Inc.
   c. Bradley Corporation.
2. Configuration: Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin).
5. Dimensions: As indicated on drawings.

F. Private-Use Soap Dish:

1. Basis of Design: Subject to compliance with requirements, provide Bestbath 6-3/4-inch x 6-3/4-inch Soap Dish. Provide basis of design product, or comparable product approved by Architect.
2. Mounting: Surface mounted.
3. Color: White.

G. Private-Use Medicine Cabinet:

1. Basis of Design: Subject to compliance with requirements, provide American Pride Vista 9400APR4. Provide basis of design product, or comparable product approved by Architect.
2. Mounting: As indicated on drawings.
3. Size: 16 by 20 inches.
4. Door: Framed mirror door concealing storage cabinet equipped with continuous hinge and spring-buffered, rod-type stop and magnetic door catch.
5. Shelves: Three, adjustable.
6. Material and Finish:
   a. Cabinet: Steel with corrosion-resistant finish.
   b. Mirror Frame: Chrome.
   c. Shelves: Match cabinet finish.

H. Private-Use Robe Hook:

1. Basis of Design: Subject to compliance with requirements, provide Basco 519 Robe Hook. Provide basis of design product, or comparable product approved by Architect.
2. Description: Single-prong unit.
3. Material and Finish: Polished chrome-plated zinc alloy (zamac).

I. Private-Use Towel Bar:

1. Basis of Design: Subject to compliance with requirements, provide Basco Contempo Series Towel Bars. Provide basis of design product, or comparable product approved by Architect.
2. Description: 5/8-inch- square tube with rectangular end brackets.
3. Mounting: Flanges with exposed fasteners.
4. Length: 5518 – 18 inch long; 5524 – 24 inch long; 5530 – 30" long
5. Material and Finish: Polished chrome-plated zinc alloy (zamac).

J. Private-Use Grab Bar:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. American Specialties Inc.; ASI Group.
   b. Bradley Corporation.
   c. Seachrome Corporation.
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel, 0.05 inch thick.
   a. Shower Area Bar Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
   b. Toilet Area Bar Finish: White powder coat.
4. Outside Diameter: 1-1/4 inches or 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

2.4 UNDERLAVATORY GUARDS

A. Underlavatory Guard: Provide in areas where lavatory piping is exposed and in direct contact with user.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Buckaroos, Inc.
   b. Plumberex Specialty Products, Inc.
   c. Truebro by IPS Corporation.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.5 FABRICATION

A. 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

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.

C. Shower Seats: Install to comply with specified structural-performance requirements.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:
   a. Portable fire extinguisher.

B. Related Requirements:

1. Section 104416 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

1.3 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. 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 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series Model 1017G.

B. Cabinet Construction: Nonrated or fire rated based on wall rating.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch-thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed 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: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Steel sheet.

G. Door Glazing: Glass.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard.
2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.
3. Provide manufacturer’s standard glass break tool.
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
   a. Identify fire extinguisher in fire-protection cabinet with the words " FIRE EXTINGUISHER."
      1) Location: Applied to cabinet door.
      2) Application Process: Silk-screened, Engraved, Etched, Decals or Pressure-sensitive vinyl letters.
      3) Lettering Color: Red.
      4) Orientation: Vertical or Horizontal.

I. 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. Tempered Float Glass: ASTM C1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, .

2.4 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.
5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. 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.

2.5 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 semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinet Mounting Height: As indicated above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

3.4 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 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

B. Related Requirements:

1. Section 104413 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

1.3 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Activar Construction Products Group, Inc. - JL Industries; Cosmic 10E.
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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 105500.13 - USPS-DELIVERY POSTAL SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cluster box units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of postal specialty.

B. Shop Drawings: For postal specialties.

1. Include plans, elevations, sections, and attachment details.
2. Include identification sequence for compartments.
3. Include layout of identification text.
4. Include setting drawings, templates, and installation instructions for anchor bolts and other anchorages installed as part of the Work of other Sections.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Furnish lock keys according to USPS requirements; with temporary identification for their respective locks, bagged, and securely taped inside the collection compartment for shipping.

PART 2 - PRODUCTS

2.1 CLUSTER BOX UNITS (CBUs)

A. Cluster Box Units (CBUs): Consisting of multiple compartments enclosed within a freestanding, pedestal-mounted enclosure. Provide access to compartments for distributing incoming mail from front of unit by unlocking master lock and swinging pair of side-hinged master doors to provide accessibility to entire group of compartments. Provide access to each compartment for removing mail by swinging compartment door. Comply with USPS-B-1118G.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AF Florence Manufacturing Company; Gibraltar Industries.
   b. National Mailboxes; NMHP, Inc.

B. Compartment Enclosure: Fabricated from aluminum sheet with aluminum mounting pedestal and weather-protection hood, with the following number and size of compartments:

1. Type II: 12 compartments 12 inches wide by 3 inches high by 15 inches deep, one outgoing mail compartment 12 inches wide by 3 inches high by 15 inches deep, and one parcel-locker compartment 12 inches wide by 10 inches high by 15 inches deep.

C. Compartment Doors and Frames: Fabricated from one-piece extruded aluminum or aluminum sheet. Equip each compartment door with lock, tenant identification, and concealed, full-length, flush hinge on one side. Provide outgoing mail slot with weather protection flap.

1. Tenant Identification: Number engraved into face of compartment door.
2. Compartment-Door Locks: Comply with USPS-L-1172C for locks and keys, or equivalent as approved by the USPS; with three keys for each compartment door. Key each compartment differently.
3. Parcel-Locker-Compartment-Door Locks: Two-key security system in which control key provides access to parcel-locker-compartment key, which opens compartment and is retained once opened.

D. Pedestal: Aluminum, with same finish as compartment enclosure and attached with theft-resistant fasteners.

E. Exposed Aluminum Finish: Finish surfaces exposed to view with powder-coated finish in color as selected by Architect from manufacturer's full range of colors .

2.2 FABRICATION

A. Form postal specialties to required shapes and sizes, with true lines and angles, square, rigid, and without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges and corners free of sharp edges and burrs and safe to touch. Fabricate doors of postal specialties to preclude binding, warping, or misalignment.

B. Preassemble postal specialties in shop to greatest extent possible to minimize field assembly.

C. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

D. Drill or punch holes required for fasteners and remove burrs. Use security fasteners where fasteners are exposed. If used, seal external rivets before finishing.

E. Weld in concealed locations to greatest extent possible without distorting or discoloring exposed surfaces. Remove weld spatter and welding oxides from exposed surfaces.

F. Fabricate tubular and channel frame assemblies with manufacturer's standard welded or mechanical joints. Provide subframes and reinforcement as required for a complete system to support loads.

G. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturers of dissimilar metals.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Protect mechanical 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 roughing-in openings, clearances, and other conditions affecting performance of the Work.

B. Examine walls and other adjacent construction for suitable conditions before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install postal specialties level and plumb, according to manufacturer's written instructions.

1. Where dissimilar metals contact each other, protect against galvanic action by painting contact surfaces with bituminous coating or by applying other permanent separation as recommended by manufacturer.
2. Where aluminum contacts grout, concrete, masonry, or wood, protect against corrosion by painting contact surfaces with bituminous coating.
3. Final acceptance of postal specialties served by the USPS depends on compliance with USPS requirements.

B. Mail Receptacles: Install mail receptacles with center of tenant-door lock cylinders and bottom of compartments at the maximum and minimum heights above finished floor established by the USPS and manufacturer's written instructions.

1. Install removable-core and keyed-in door lock cylinders as required for each type of cylinder lock.

C. Pedestal-Mounted Postal Specialties: Anchor units with 1/2-inch- diameter, stainless-steel anchor bolts with hooked ends.

D. Collection Boxes: Install collection boxes with centerline of mail slots handle of hopper doors not more than 48 inches above finished floor.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as postal specialties are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors, hardware, and moving parts to function smoothly, and lubricate as recommended by manufacturer. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace postal specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by postal-specialty manufacturer.

D. Replace postal specialties that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

E. On completion of postal-specialty installation, clean interior and exterior surfaces as recommended by manufacturer.

END OF SECTION 105500.13

SECTION 113013 - RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Apartment Unit appliances.
2. Community Kitchen appliances.

B. Related Requirements:

1. See drawings for "Residential Plumbing Fixtures" for kitchen sinks, dishwasher air-gap fittings, waste (garbage) disposers, and instant hot-water dispensers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of appliance.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain residential appliances from single source and each type of residential appliance from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

2.3 APARTMENT UNIT APPLIANCES

A. Electric Range: Freestanding range with one oven(s) and complying with AHAM ER-1 and accessibility requirements.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. GE Appliances; Haier Group: JBS460DMWW.
2. Width: 30 inches.
3. Electric Burner Elements: Four .
   a. Coil Type: Manufacturer's standard .
   b. Controls: Digital panel controls, located on front .
4. Oven Features:
   a. Capacity: 5.0 cu. ft. .
   b. Operation: Baking convection and pyrolytic self-cleaning or catalytic continuous cleaning.
   c. Broiler: Located in top of oven separate roll-out drawer on bottom.
   d. Oven Door(s): Counterbalanced, removable, with observation window and full-width handle.
   e. Electric Power Rating:
      1) Oven(s): Manufacturer's standard.
      2) Broiler: Manufacturer's standard.
   f. Controls: Dial or digital panel controls and timer display, located on front .
5. Anti-Tip Device: Manufacturer's standard.
6. Accessories: Metal grease shield(s) as indicated on drawings to match finish and color of appliance.
7. Electric Power Supply: As indicated on Drawings or existing power supply.
8. Material: Porcelain-enameled steel with manufacturer's standard cooktop.
   a. Color/Finish: White.
9. Features: Complies with accessibility requirements.

B. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on top and complying with AHAM HRF-1 and accessibility requirements.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. GE Appliances; Haier Group: GTE19DTNRWW.
2. Type: Freestanding .
3. Dimensions:
   a. Width: 29-3/4 inches.
   b. Depth: 34-1/2 inches.

c. Height: 66-3/8 inches.

4. Storage Capacity:
   a. Total Capacity: 19.2 cu. ft.
   b. Refrigeration Compartment Volume: 13.59 cu. ft.
   c. Freezer Volume: 5.57 cu. ft.
5. Freezer Features: Automatic defrost.
6. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
7. Front Panel(s): Manufacturer's standard .
   a. Panel Color: White .
8. Appliance Color/Finish: White .
9. Features: Complies with accessibility requirements.

C. Overhead Exhaust Hood:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. GE Appliances; Haier Group: JVX3300DJWW.
2. Type: Under cabinet mounted, exhaust-hood system.
3. Dimensions:
   a. Width: 29-7/8 inches.
   b. Depth: 20 inches.
   c. Height: 5-1/2 inches.
4. Exhaust Fan: Two -speed fan with manufacturer's standard 200-cfm capacity.
   a. Venting: Vented to outside through existing duct system.
   b. Fan Control: Remote wired fan switch, with separate hood-light control switch in accessible unit types.
5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
6. Finish: Baked enamel.
   a. Color: White.
7. Features: Complies with accessibility requirements.

D. Dishwasher (Standard Units): Complying with AHAM DW-1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. GE Appliances; Haier Group: GDT535PGRWW.
2. Type: Built-in undercounter.
3. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
4. Front Panel: Manufacturer's standard.
5. Appliance Color/Finish: White.

E. Dishwasher (Accessible Units): Complying with AHAM DW-1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. GE Appliances; Haier Group: GDT226SGLWW.
2. Type: Built-in undercounter.

3. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
4. Front Panel: Manufacturer's standard.
5. Appliance Color/Finish: White.

2.4 COMMUNITY KITCHEN APPLIANCES

A. Electric Range: Freestanding range with one oven(s) and complying with AHAM ER-1 and accessibility requirements.

1. Basis of Design: Subject to compliance with requirements, provide Electric Range JBS460DM by GE Appliances; Haier Group. Provide basis of design product, or comparable product approved by Architect.
2. Width: 30 inches.
3. Controls: Dial or digital panel controls and timer display, located on front.
4. Anti-Tip Device: Manufacturer's standard.
5. Accessories: Metal grease shield(s) as indicated on drawings to match finish and color of appliance.
6. Material: Porcelain-enameled steel with manufacturer's standard cooktop.
   a. Color/Finish: White.

B. Refrigerator/Freezer: French door refrigerator with freezer on bottom, complying with AHAM HRF-1 and accessibility requirements.

1. Basis of Design: Subject to compliance with requirements, provide Refrigerator/Freezer GNE25JMK by GE Appliances; Haier Group. Provide basis of design product, or comparable product approved by Architect.
2. Type: Freestanding.
3. Dimensions:
   a. Width: 32-3/4 inches.
   b. Depth: 35 inches.
   c. Height: 69-7/8 inches.
4. Total Storage Capacity: 24.8 cu. ft.
5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
6. Front Panel(s): Manufacturer's standard.
   a. Panel Color: White.
7. Appliance Color/Finish: White.

C. Overhead Exhaust Hood:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Summit Appliance; Model ADAH1630.
2. Type: Wall-mounted, exhaust-hood system.
3. Dimensions:
   a. Width: 30 inches.
   b. Depth: 18 inches.
4. Exhaust Fan: Two -speed fan with manufacturer's standard 270-cfm capacity.
   a. Venting: Vented to outside.
   b. Fan Control: Remote wired fan switch, with separate hood-light control switch.

5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
6. Finish: Baked enamel.
   a. Color: White.
7. Accessories: Furnish Stovetop Firestop rangehood canisters over each burner. Basis of design Stovetop Firestop 675-3D.
8. Features: Complies with accessibility requirements.

D. Dishwasher: Complying with AHAM DW-1 and accessibility requirements.

1. Basis of Design: Subject to compliance with requirements, provide Dishwasher GDT225SGL by GE Appliances; Haier Group. Provide basis of design product, or comparable product approved by Architect.
2. Type: Built-in undercounter.
3. Dimensions:
   a. Width: 23-3/4 inches
   b. Depth: 23-1/2 inches.
   c. Height: 32-1/4 inches.
4. Sound Level: Maximum 51dB.
5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
6. Front Panel: Manufacturer's standard.
   a. Panel Color: White.
7. Appliance Color/Finish: White.

E. Microwave Oven: Countertop microwave oven complying with requirements.

1. Basis of Design: Subject to compliance with requirements, provide Microwave Oven PES7227DL by GE Appliances; Haier Group. Provide basis of design product, or comparable product approved by Architect.
2. Dimensions:
   a. Width: 24-1/8 inches
   b. Depth: 19-3/4 inches.
   c. Height: 14 inches.
3. Capacity: 2.2 cu. ft.
4. Color/Finish: White.

2.5 GENERAL FINISH REQUIREMENTS

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

B. 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, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where overhead exhaust hoods will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Range Anti-Tip Device: Install at each range according to manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 113013

SECTION 122116 - VERTICAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vertical louver blinds with PVC vanes.

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, 12 inches long.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, and location of installation using same designations indicated on Drawings.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not install vertical louver blinds until construction and wet-work and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where vertical louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vertical louver blinds from single source from single manufacturer.

2.2 VERTICAL LOUVER BLINDS, PVC VANES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hunter Douglas Contract.
2. Levolor.
3. Springs Window Fashions; SWFcontract.

B. Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with not less than 3/8-inch overlap when vanes are rotated fully closed.

1. Width: 3-1/2 inches.
2. Profile: Flat Embossed .
3. Flame-Resistance Rating: Comply with NFPA 701; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

C. Headrail: Channel, formed steel or extruded aluminum with long edges returned or rolled and ends capped. Headrail encloses operating mechanisms including carrier-spacing mechanism that provides uniform vane spacing when blinds are traversed fully across headrail (closed).

1. Manual Traverse Control: Cord.
2. Manual Rotation Control: Chain.
3. Manual Control Locations: Match existing locations.
4. Draw and Stack: Match existing stack location.
5. Cord-Tensioner Mounting: Wall.

D. Carriers: Engineered plastic with gears to align and synchronize vane rotation and stems that allow vane removal and replacement. Lead carriers have self-lubricating wheels or elongated bearing surfaces; remaining carriers have self-lubricating wheels.

E. Valance: Manufacturer's standard with vane insert.

F. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.

1. Type: For headrail recessed in pocket.
2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

G. Colors, Textures, and Patterns:

1. Vanes: As selected by Architect from manufacturer's full range.
2. Components: Provide materials exposed to view matching or coordinating with vanes unless otherwise indicated.

2.3 VERTICAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate vertical louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to cover window and other openings as follows, measured at 74 deg F:

1. Outside of Jamb Installation: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Rotation-and-Traverse Mechanisms: With permanently lubricated moving parts.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware and for bracket positions and blind mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to brackets and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view unless anodized or plated finish is indicated. Apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install vertical louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.

1. Locate so exterior vane edges are not closer than 2 inches from interior faces of glass and not closer than 1-1/2 inches from interior faces of glazing frames through full operating ranges of blinds.
2. Install mounting and intermediate brackets to prevent deflection of headrails.
3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

3.3 ADJUSTING

A. Adjust vertical louver blinds to operate free of binding or malfunction through full operating ranges.

3.4 CLEANING AND PROTECTION

A. Clean vertical louver blind surfaces after installation according to manufacturer's written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures that vertical louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged vertical louver blinds that cannot be repaired in a manner approved by Architect before time of Substantial Completion.

END OF SECTION 122116

SECTION 123530 - RESIDENTIAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes kitchen and vanity cabinets.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking for anchoring casework.
2. Section 123623.13 "Plastic-Laminate-Clad Countertops."
3. Section 123661.16 "Solid Surfacing Countertops."
4. Section 123661.19 "Quartz Agglomerate Countertops."

1.2 COORDINATION

A. Coordinate layout and installation of blocking and reinforcement in partitions for support of casework.

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 for casework.
2. Include rated capacities, operating characteristics, profiles, and finishes for hardware.

B. Shop Drawings: For residential casework.

1. Include plans, elevations, details, and attachments to other work.
2. Show materials, finishes, filler panels, and hardware.
3. Indicate manufacturer's catalog numbers for casework.

C. Samples: For casework and hardware finishes.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Established Dimensions: Where casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes to allow for trimming and fitting.

D. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before enclosing them, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 CABINET MATERIALS

A. Hardwood Lumber: Kiln dried to 7 percent moisture content.

B. Softwood Lumber: Kiln dried to 10 percent moisture content.

C. Hardwood Plywood: HPVA HP-1.

D. Particleboard: ANSI A208.1, Grade M-2.

E. MDF: Medium-density fiberboard, ANSI A208.2, Grade MD.

F. Hardboard: ANSI A135.4, Class 1 tempered.

G. Exposed Materials:

1. Exposed Wood Species: Maple .
    a. Select materials for compatible color and grain. Do not use two adjacent exposed surfaces that are noticeably dissimilar in color, grain, figure, or natural character markings.
    b. Staining and Finish: As selected by Architect from manufacturer's full range.
2. Solid Wood: Clear hardwood lumber of species indicated, free of defects.

H. Semiexposed Materials: Unless otherwise indicated, provide the following:

1. Plywood: Hardwood plywood with Grade C faces and not less than Grade 3 backs of same species as faces. Face veneers of same species as exposed surfaces or stained to be compatible with exposed surfaces.

I. Concealed Materials: Solid wood or plywood, of any hardwood or softwood species, with no defects affecting strength or utility; particleboard; MDF; or hardboard.

2.2 MANUFACTURERS

A. Basis of Design: Smart Cabinetry, Brighton Mortise and Tenon Door, Veneer Flat Panel, Solid Drawer Front Cabinetry. Provide basis of design product, or comparable product approved by Architect.

1. Smart Cabinetry

2.3 CABINET HARDWARE

A. General: Manufacturer's standard units complying with BHMA A156.9, of type, size, style, material, and finish as selected by Architect from manufacturer's full range.

B. Pulls: Back-mounted decorative pulls.

C. Hinges: Concealed European-style, self-closing hinges.

D. Drawer Guides: Epoxy-coated-metal, self-closing drawer guides; designed to prevent rebound when drawers are closed; with nylon-tired, ball-bearing rollers; and complying with BHMA A156.9, Type B05011 or Type B05091.

E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of casework.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install casework with no variations in adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework.

B. Install casework without distortion so doors and drawers fit the openings, are aligned, and are uniformly spaced. Complete installation of hardware and accessories as indicated.

C. Install casework level and plumb to a tolerance of 1/8 inch in 8 feet.

D. Fasten casework to adjacent units and to backing.

1. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c.
   a. Fasteners: No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips .

3.3 ADJUSTING AND CLEANING

A. Adjust hardware so doors and drawers are centered in openings and operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

B. Clean casework on exposed and semiexposed surfaces. Touch up as required to restore damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 123530

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.

B. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.4 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations with Humidity Control: Do not deliver or install countertops 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 period.

C. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate

measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are 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 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI certification program indicating that countertops comply with requirements of grades specified.

B. Grade: Economy.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP.

1. Refer to Master Finish Schedule for product information.

D. Edge Treatment: As indicated on Drawings.

E. Core Material: Particleboard.

F. Core Material at Sinks: Particleboard made with exterior glue.

G. Core Thickness: 3/4 inch.

1. Build up countertop thickness to 1-1/2 inches at front, back, and ends with additional layers of core material laminated to top.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.

1. Wood Moisture Content: 5 to 10 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2 Grade M-2-Exterior Glue.

2.3 ACCESSORIES

2.4 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

B. Installation Adhesive:

1. Verify adhesives have a VOC content of 70 g/L or less.

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:

1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.

D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
2. Seal edges of cutouts by saturating with varnish.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
2. Secure backsplashes to walls with adhesive.
3. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material sinks.
5. Solid surface window stools.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples for Initial Selection: For each type of material exposed to view.

1.3 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Refer to Master Finish Schedule for product information.
2. Type: Provide Standard type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.
3. Integral Sink Bowls: Comply with CSA B45.5/IAPMO Z124.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Economy.
2. Countertops: 3/4-inch- thick, solid surface material with front edge built up with same material.
    a. Build up countertop thickness to 1-1/2 inches at front, back, and ends.

B. Backsplashes: 3/4-inch- thick, solid surface material.

C. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

D. Joints: Fabricate countertops without joints.

E. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 SOLID SURFACE WINDOW STOOL MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Refer to Master Finish Schedule for product information.
2. Type: Provide Standard type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.

2.4 WINDOW STOOL FABRICATION

A. Fabricate window stools according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Economy.
2. Window Stools: 3/4-inch- thick, solid surface material with front edge built up with same material.
    b. Build up window stool thickness to 1-1/2 inches at front, back, and ends.

B. Fabricate stools with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

C. Joints: Fabricate window stools without joints.

2.5 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.

B. Sealant for Countertops and Window Stools: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

D. Install window stools by adhering to perimeter framing with adhesive. Mask window surfaces adjacent to joints to prevent adhesive smears.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

F. Apply sealant to gaps at walls and windows; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 123661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops.
2. Quartz agglomerate backsplashes.
3. Quartz agglomerate end splashes.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for sinks and plumbing fittings.

1.2 ACTION SUBMITTALS

A. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

B. Samples for Initial Selection: For each type of material exposed to view.

1.3 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.4 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Refer to Master Finish Schedule for product information.

B. Particleboard: ANSI A208.1, Grade M-2 .

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Economy.

B. Countertops: 3/4-inch- thick, quartz agglomerate with front edge built up with same material.

C. Backsplashes: 1/2-inch- thick, quartz agglomerate.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Joint Type: Bonded, 1/32 inch or less in width.
3. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
   a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

END OF SECTION 123661.19

SECTION 142123.16 - MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Machine-room-less electric traction passenger elevators.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.

B. Shop Drawings:

1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
2. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples: For each type of exposed finish involving color selection.

1.3 CLOSEOUT SUBMITTALS

A. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard five-year maintenance agreement, starting on date initial maintenance service is concluded.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Shindler 3100 MRL Low-Rise Traction Elevator with 3,000 lbs. capacity. Provide basis of design product, or comparable product approved by Architect.

1. KONE Inc.
2. Otis Worldwide Corporation.
3. Schindler Elevator Corp.
4. ThyssenKrupp Elevator.

2.2 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.

B. Accessibility Requirements: Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines, ICC A117.1 and with IBC Stretcher Requirements.

2.3 ELEVATORS

A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.

B. Elevator Description:

1. Elevator Number: 1.
2. Rated Load: 3000 lb.
3. Freight Loading Class for Service Elevator(s): Class A.
4. Rated Speed: 100 fpm.
5. Operation System: Selective-collective automatic operation.
6. Auxiliary Operations:
    a. Standby power operation.
    b. Battery-powered automatic evacuation.
    c. Nuisance-call cancel.
    d. Automatic operation of lights and ventilation fans.
    e. Service at all floors.
7. Car Enclosures:
    a. Inside Width: Not less than 81-5/16 inches from side wall to side wall.
    b. Inside Depth: Not less than 58-7/8 inches from back wall to front wall (return panels).
    c. Inside Height: Not less than 93 inches to underside of ceiling.
    d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
    e. Car Fixtures: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
    f. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/A480M, No. 4 finish.
    g. Reveals: Black.
    h. Door Faces (Interior): Satin stainless steel, ASTM A480/A480M, No. 4 finish.
    i. Ceiling: Luminous ceiling.
    j. Handrails: 1-1/2 inches round satin stainless steel, at sides of car.
    k. Floor prepared to receive resilient flooring (specified in Section 09 65 16 "Resilient Sheet Flooring").
8. Hoistway Entrances:
    a. Width: 42 inches.
    b. Height: 84 inches.
    c. Type: Two-speed side sliding.
    d. Frames : Satin stainless steel, ASTM A480/A480M, No. 4 finish.
    e. Doors : Satin stainless steel, ASTM A480/A480M, No. 4 finish.
9. Hall Fixtures : Satin stainless steel, ASTM A480/A480M, No. 4 finish.
10. Additional Requirements:

a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/A480M, No. 4 finish.
b. Provide hooks for protective pads in car and one complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.

1. Provide regenerative or nonregenerative system.
2. Provide regenerative system that complies with the IgCC.
3. Limit total harmonic distortion of regenerated power to 5 percent per IEEE 519.
4. Provide means for absorbing regenerated power when elevator system is operating on standby power.
5. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.

B. Fluid for Hydraulic Buffers: Fire-resistant fluid.

C. Machine Beams: Provide steel framing to support elevator hoisting machine and deflector sheaves from the building structure. Comply with Section 05 50 00 "Metal Fabrications" for materials and fabrication.

D. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

A. Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.

B. Auxiliary Operations:

1. Single-Car Standby Power Operation: On activation of standby power, car is returned to a designated floor and parked with doors open. Car can be manually put in service on standby power, either for return operation or for regular operation, by switches in control panel located at fire-command station. Manual operation causes automatic operation to cease.
2. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
3. Service: Service is initiated by a keyswitch at designated floors. On arriving at the floor, elevator opens its doors and parks. Car is placed in operation by selecting a floor and pressing door close button or by operating keyswitch to put car in independent service. After responding to floor selected or being removed from independent service, car is returned to operation.

C. Security features shall not affect emergency firefighters' service.

2.6 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

A. Provide enameled or powder-coated steel car enclosures to receive removable wall panels, with removable car roof, access doors, power door operators, and ventilation.

1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.

B. Materials and Finishes: Manufacturer's standards, but not less than the following:

1. Stainless Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless steel sheet.
2. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder-coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
3. Sight Guards: Provide sight guards on car doors.
4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
5. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
6. Light Fixture Efficiency: Not less than 35 lumens/W.
7. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

2.8 HOISTWAY ENTRANCES

A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.

1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.

B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

1. Fire-Protection Rating: 1 hour with 30-minute temperature rise of 450 deg F.

C. Materials and Fabrication: Manufacturer's standards, but not less than the following:

1. Stainless Steel Frames: Formed from stainless steel sheet.
2. Star of Life Symbol: Identify emergency elevators with star of life symbol, not less than 3 inches high, on both jambs of hoistway door frames.
3. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet or by laminating stainless steel sheet to exposed faces and edges of enameled or powder-coated steel doors using adhesive that fully bonds metal to metal without telegraphing or oil-canning.
4. Sight Guards: Provide sight guards on doors matching door edges.
5. Sills: Extruded or machined metal, with grooved surface, 1/4 inch thick.
6. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

2.9 SIGNAL EQUIPMENT

A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.

B. Car-Control Stations: Provide manufacturer's standard recessed or car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.

1. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.

C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.

E. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.

F. Hall Push-Button Stations: Provide one hall push-button station at each landing.

G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:

1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
2. Units mounted in both jambs of entrance frame.

H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.

I. Fire-Command-Center Annunciator Panel: Provide panel containing illuminated position indicators for each elevator, clearly labeled with elevator designation; include illuminated

signal that indicates when elevator is operational and when it is at the designated emergency return level with doors open. Provide standby power elevator selector switch(es), as required by ASME A17.1/CSA B44, adjacent to position indicators. Provide illuminated signal that indicates when normal power supply has failed.

J. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.

C. Stainless Steel Sheet: ASTM A240/A240M, Type 304.

D. Stainless Steel Bars: ASTM A276, Type 304.

E. Stainless Steel Tubing: ASTM A554, Grade MT 304.

F. Aluminum Extrusions: ASTM B221, Alloy 6063.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.

B. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.

C. Leveling Tolerance: 1/8 inch, up or down, regardless of load and travel direction.

D. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

E. Locate hall signal equipment for elevators as follows unless otherwise indicated:

1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
2. Place hall lanterns either above or beside each hoistway entrance.
3. Mount hall lanterns at a minimum of 72 inches above finished floor.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.

3.3 PROTECTION

A. Temporary Use: Comply with the following requirements for elevator used for construction purposes:

1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
2. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
3. Engage elevator Installer to provide full maintenance service.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate elevator(s).

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity.

END OF SECTION 142123.16

SECTION 149182 - TRASH CHUTES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Waste chutes.

1.2 DEFINITIONS

A. Access Door: Door other than an intake or discharge door that penetrates the chase wall for service access to devices in the chase.

B. Chase: The shaft that encloses a chute.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include diagrams for power, signal and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Chute Systems, Inc.
2. Midland Chutes.
3. U.S. Chutes; U.S.C. Group.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design", the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing and inspecting agency, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Intake Doors: Labeled, 1-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.
3. Access Doors: Labeled, 1-hour fire-resistance rated with 30-minute temperature rise of 250 deg F.

C. Discharge-Door Assemblies: Fire-resistive door construction according to NFPA 252 or UL 10B requirements for fire-rated door assemblies.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Standard: Provide chutes complying with NFPA 82.

2.3 WASTE CHUTES

A. Chute Metal: Type 304 stainless steel, ASTM A240/A240M .

1. Thickness: 0.0625 inch.

B. Chute Size: 24-inch diameter.

2.4 WASTE CHUTE DOORS

A. Intake-Door Assemblies: ASTM A240/A240M, Type 304, stainless steel self-closing units with positive latch and latch handle, with stainless steel trim; constructed as required for performance requirements indicated; and with frame suitable for the enclosing chase construction.

1. Door Type: Hopper.
2. Size: Manufacturer's standard size for door type, chute type, and diameter indicated.
3. Finish: Manufacturer's standard satin or ASTM A480/A480M No. 3 directional polish.
4. Accessible Automatic Door Operating System: Manufacturer's standard system complying with applicable provisions of the cited accessibility standard.
5. Baffles: Rubber backdraft baffles at each intake.

B. Discharge-Door Assemblies: Aluminum-coated steel; direct vertical-discharge type, inclined, and horizontally closing and latching; constructed as required for performance requirements indicated; and equipped with 165 deg F fusible links that cause doors to close in the event of fire.

C. Detector System: Heat and smoke detecting interlock system with temperature-rise elements that locks chute doors when temperature in chute reaches a predetermined, adjustable temperature.

1. Locate smoke detector outside discharge door with solenoid to close discharge door.

D. Access-Door Assemblies: Manufacturer's standard ASTM A240/A240M, Type 302/304, stainless steel doors with trim; constructed as required for performance requirements indicated; with frame suitable for the enclosing chase construction; in satin or ASTM A480/A480M No. 3 directional polish finish; equipped with cylinder locks that release latch with keys that are removable only when cylinder is locked.

1. Lock Cylinder: Cylinders standard with manufacturer.
2. Keying: Key access-door cylinders alike.
3. Keys: Three for each cylinder.

E. Manual Control System: Control system with manual switches that lock chute doors during shutdown hours and service operations.

2.5 ACCESSORIES

A. Flushing Spray Unit: NPS 3/4 spray-head unit located in chute above highest intake door, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.

B. Sanitizing Unit: NPS 3/4 disinfecting and sanitizing spray-head unit located in chute above highest intake door, including 1-gal. tank and adjustable proportioning valve with bypass for manual control of sanitizing and flushing operation, ready for hot-water piping connection, and with access door for spray-head and piping maintenance.

2.6 FABRICATION

A. Factory-assemble chutes to greatest extent practicable.

B. Roof Vent: Extend vent to height above roofing surface as indicated on Drawings. Equip vent with full insect screening and metal explosion-release cap. Fabricate with roof-deck flange, counterflashing, and clamping ring of nonferrous metal compatible with chute metal.

C. Equipment Access: Fabricate chutes with access for maintaining equipment located within the chute, such as flushing and sanitizing units, fire sprinklers, and plumbing and electrical connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and test chutes before installing enclosing chase construction.

B. Install chutes according to NFPA 82 and manufacturer's written instructions.

C. Install chutes plumb, without obstructions that might prevent materials from free falling within chutes.

D. Anchor flanges of chute vents to roof curbs before installing roofing and flashing. Install chute-vent counterflashing after roofing and roof-penetration flashing are installed.

E. Interconnect sanitizer control with door interlock system.

F. Electrical Interlock System: Install according to applicable NECA 1 recommendations.

G. Test and adjust chute components after installation. Operate doors, locks, and interlock systems to demonstrate that hardware operates properly and smoothly and electrical wiring is connected correctly.

H. Test heat and smoke sensing devices for proper operation.

I. Operate sanitizing unit through one complete cycle of chute use and cleanup, and replenish chemicals or cleaning fluids in unit containers.

3.2 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain each chute and related equipment.

END OF SECTION 149182

DIVISIONS 21 – FIRE SUPPRESSION

21 00 00 GENERAL PROVISIONS

1. General Conditions of the Contract for Construction, AIA A201, and Division 1 shall be part of this contract.
2. Articles contained in the Mechanical and Architectural Specifications may amend, modify, supersede, void or supplement the Articles of the General Conditions, and shall take precedence over the provisions of the General Conditions where differences occur.
3. Provide all work and materials as required herein and on drawings in full accordance with National, State and local Codes, Ordinances and/or regulations having jurisdiction over work.
4. Furnish all labor and materials to provide a complete, functioning installation including fire protection as shown on the drawings and specified herein. All systems shall be complete and shall function to the satisfaction of the Owner and the Engineer upon project completion.
5. Take out all necessary permits, licenses and certificates and pay all fees connected therewith.
6. Visit the site and become familiar with all conditions surrounding the work.
7. Drawings are diagrammatic and intended to show approximate locations unless specifically dimensioned. Coordinate work with existing conditions and other trades to avoid interference.
8. Do all cutting and patching required to install any portion of the mechanical work. Patch with new materials of the same types that were removed. Refinish patched surfaces to match existing adjacent surfaces. Roof penetrations and patching shall be performed by the General Contractor, but at the expense of the Mechanical Contractor.
9. Submit shop drawings for all equipment and material furnished under this contract.
10. Substitutions of equipment other than the types and makes specified in the base design shall be done only by approval, in advance, from the Engineer. Written requests for substitutes of material and equipment must be submitted through a bidding contractor and received by the Engineer no later than ten (10) calendar days prior to bid opening.
11. Touch up or refinish the factory finish of equipment marred during shipment or installation.
12. At the completion of the work, Contractor shall remove all rubbish, dirt and stains caused by his work and shall thoroughly clean all mechanical work including equipment, appliances, fixtures, ductwork, piping, etc.
13. Record Drawings: As work progresses, record all changes and deviations from the contract documents on a set of construction drawings, including underground and concealed aboveground piping and ductwork. Upon completion of contract, turn over this set of drawings to the Engineer.
14. Guarantee: Contractor shall guarantee all work and materials for a period of one (1) year. Defects of any kind due to faulty work or materials appearing during the above-mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner. Such reconstruction and repairs shall include all damage to the finish or furnishings of the building resulting from the original defect or repairs thereto.
15. Operation and Maintenance Manuals: Assemble and transmit to the Owner two (2) combined sets of shop drawings, manufacturer's bulletins and other data as required covering the care, maintenance, and operation of each piece of equipment furnished, including at a minimum – equipment capacities and required maintenance actions; all manufacturer's published O&M documents; HVAC system control maintenance and calibration information, including wiring diagrams, schematics and control sequences of operation, programmed set points; and a complete narrative of how equipment is intended to operate.

16. Start-up and Owner Training: The operating personnel shall be fully instructed by the Contractor in the operation of each mechanical system before acceptance of the work. Training records shall be signed by the instructor and each person receiving training, and submitted to the Owner's representative prior to project close-out. Training sessions shall be recorded in DVD format and turned over to the owner.

21 13 00 FIRE SUPPRESSION SPRINKLER SYSTEMS

1. Fire protection system drawings and hydraulic calculations shall be prepared and certified by a qualified professional engineer with expertise in fire protection design and registered in the state in which the project is located. Where acceptable by the State, a qualified NICET Registered Designer may prepare and certify the submittal drawings and/or hydraulic calculations. It is the contractor's responsibility to determine State requirements for certification of calculations.
2. Fire Protection Contractor shall determine flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and conduct all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than three (3) years. Hydraulic calculations shall include a minimum 5% safety factor, or greater as required by the Authority Having Jurisdiction or the Owner's Insurance Underwriter.
3. Approval Drawings: Prepare approval drawings of fire protection systems indicating pipe sizes, pipe locations, fittings, shutoffs, equipment, and similar information. Submit to agency having jurisdiction for approval.
4. Upon completion of work, submit four bound copies of complete typewritten operating instructions, parts lists, and service manuals of equipment, wiring diagrams, control diagrams, and test reports to the Owner. In addition, post one copy of complete instructions in Water Service Room.
5. Review complete drawings and specifications of other trades before installing work. After checking, consider the work of other trades and coordinate work to obtain the best arrangement of equipment, piping, conduit, ducts, and other construction.
6. Conform to NFPA 13 for piping, fittings, and methods of joining. Piping and/or tubing shall have minimum nominal wall thickness in accordance with Schedule 10, and approved by local codes. Foreign made pipe may be used if it meets applicable ANSI and ASTM standards and complies with NFPA acceptance tests. Paint piping located in corrosive environment or wet spaces with two (2) coats of approved corrosive resistance paint.
7. Drain Piping: Schedule 40 galvanized steel with cast iron fittings. Paint piping located in corrosive environment or wet spaces with two (2) coats of approved corrosion resistant paint.
8. Sprinkler heads: Provide UL and FM listed sprinkler heads conforming to NFPA requirements for intended use. Sprinkler heads located in hazard environment areas shall be factory coated with a corrosion resistant paint appropriate for the space installed.
9. Miscellaneous appurtenances:
    A. Provide a 2" main drain connection for each sprinkler riser, including an angle valve, pressure gauge and 1/4" brass valves with 1/4" brass test plug.
    B. Provide an inspector test connection terminating with a smooth bore orifice sized to give the equivalent water flow of the sprinkler with the lowest K factor (smallest orifice size) in the sprinkler system.

C. Provide a UL and FM approved automatic ball drip.

10. Alarms and Switches:
    A. Provide UL and FM listed vane type water flow switch with two sets of single pole, double throw contacts suitable for 120V AC and 24V DC operation. Switch shall indicate a leak or flow of water in excess of 10 gpm. Potter Electric Signal Company, Model No. VSR-F.
11. Hydrostatically test piping at not less than 200 psig, or 50 psig above static pressure in excess of 150 psig for a period of not less than two hours. Inspect pipe joints while system is under test pressure and correct visible leaks to the satisfaction of Owner construction manager. If necessary, piping shall be dismantled and reassembled with the use of new pipe or fittings. No caulking or makeshift method of temporary repair of defective work will be permitted. Repeat tests until line or system receives approval of Owner construction manager.
12. Instructions to personnel: Prior to acceptance, provide an experienced engineer to instruct Owner personnel about self-inspection procedures, tests, care, and maintenance functions necessary to keep system in good operative condition.
13. Scope of work: Work includes providing a complete new fire protection sprinkler system as required to accommodate the new building.
    A. Coordinate pipe and head layout and installation with structural, mechanical and electrical trades, and ceiling layout.
    B. Verify required sprinkler locations with local authorities.
    C. All exposed sprinkler pipe in open ceiling areas shall be installed in joist space.
    D. Coordinate exact location of inspector tests with General Contractor.
    E. Contractor shall have a thorough knowledge of all drawings, specifications and existing conditions prior to bid. Failure to acquire such knowledge will not relieve the responsibility of this contractor for performing the work properly. No additional compensation shall be allowed due to the contractor's failure to become familiar with existing conditions.

END OF SECTION

DIVISIONS 22 – PLUMBING

22 00 00 GENERAL PROVISIONS

1. General Conditions of the Contract for Construction, AIA A201, and Division 1 shall be part of this contract.
2. Articles contained in the Mechanical and Architectural Specifications may amend, modify, supersede, void or supplement the Articles of the General Conditions, and shall take precedence over the provisions of the General Conditions where differences occur.
3. Provide all work and materials as required herein and on drawings in full accordance with National, State and local Codes, Ordinances and/or regulations having jurisdiction over work.
4. Furnish all labor and materials to provide a complete, functioning installation including plumbing, heating, ventilating, air conditioning, fire protection and temperature control as shown on the drawings and specified herein. All systems shall be complete and shall function to the satisfaction of the Owner and the Engineer upon completion of the Project.
5. Take out all necessary permits, licenses and certificates and pay all fees connected therewith.
6. Visit the site and become familiar with all conditions surrounding the work.
7. Drawings are diagrammatic and intended to show approximate locations unless specifically dimensioned. Coordinate work with existing conditions and other trades to avoid interference.
8. Do all cutting and patching required to install any portion of the mechanical work. Patch with new materials of the same types that were removed. Refinish patched surfaces to match existing adjacent surfaces. Roof penetrations and patching shall be performed by the General Contractor, but at the expense of the Mechanical Contractor.
9. Submit shop drawings for all equipment and material furnished under this contract.
10. Substitutions of equipment other than the types and makes specified in the base design shall be done only by approval, in advance, from the Engineer. Written requests for substitutes of material and equipment must be submitted through a bidding contractor and received by the Engineer no later than ten (10) calendar days prior to bid opening.
11. Touch up or refinish the factory finish of equipment marred during shipment or installation.
12. At the completion of the work, Contractor shall remove all rubbish, dirt and stains caused by his work and shall thoroughly clean all mechanical work including equipment, appliances, fixtures, ductwork, piping, etc.
13. Record Drawings: As work progresses, record all changes and deviations from the contract documents on a set of construction drawings, including underground and concealed aboveground piping and ductwork. Upon completion of contract, turn over this set of drawings to the Engineer.
14. Guarantee: Contractor shall guarantee all work and materials for a period of one (1) year. Defects of any kind due to faulty work or materials appearing during the above-mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner. Such reconstruction and repairs shall include all damage to the finish or furnishings of the building resulting from the original defect or repairs thereto.
15. Operation and Maintenance Manuals: Assemble and transmit to the Owner two (2) combined sets of shop drawings, manufacturer's bulletins and other data as required covering the care, maintenance, and operation of each piece of equipment furnished, including at a minimum – equipment capacities and required maintenance actions; all manufacturer published O&M documents; HVAC system control maintenance and calibration information, including wiring diagrams, schematics and control sequences of operation, programmed set

points; and a complete narrative of how equipment is intended to operate.

16. Start-up and Owner Training: The operating personnel shall be fully instructed by the Contractor in the operation of each mechanical system before acceptance of the work. Training records shall be signed by the instructor and each person receiving training, and submitted to the Owner representative prior to project close-out. Training sessions shall be recorded in DVD format and turned over to the owner.

22 02 00 BASIC MATERIALS AND METHODS–PIPING

1. All piping material and methods of construction and workmanship shall be provided as per the requirements of governing codes and regulations.
2. Underground Piping
    A. Sanitary Sewer
        1. Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, with plain ends, conforming to ASTM D2665. Joints shall be solvent weld socket type with solvent recommended by manufacturer and of contrasting color. Cellular core piping is not acceptable. Do not use where exposed or in return air plenums. Only allowed where permitted by the local jurisdiction. Comply with all special requirements or limitations.
        2. Bell and spigot cast iron with neoprene compression joints.
        3. Hubless cast iron. Where stainless steel bands are used, coat bands and other hardware with Bitumastic material.
    B. Storm Sewer
        1. Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, with plain ends, conforming to ASTM D2665. Joints shall be solvent weld socket type with solvent recommended by manufacturer and of contrasting color. Cellular core piping is not acceptable. Do not use where exposed or in return air plenums. Only allowed where permitted by the local jurisdiction. Comply with all special requirements or limitations.
        2. Bell and spigot cast iron with neoprene compression joints.
        3. Hubless cast iron. Where stainless steel bands are used, coat bands and other hardware with Bitumastic material.
3. Aboveground Piping
    A. Sanitary Sewer, Vent, Storm Sewer
        1. Schedule 40 rigid, unplasticized PVC-DWV, or ABS-DWV, with plain ends, conforming to ASTM D2665. Joints shall be solvent weld socket type with solvent recommended by manufacturer and of contrasting color. Cellular core piping is not acceptable. Do not use in return air plenums and protect where exposed. Only allowed where permitted by the local jurisdiction. Comply with all special requirements or limitations. Provide expansion loops and/or expansion joints where required by manufacturer's guidelines.
        2. Schedule 40 PVC or ABS is acceptable for vents, except within air plenum ceilings.
        3. Bell and spigot cast iron with neoprene compression joints.
        4. Hubless cast iron. Where stainless steel bands are used, coat bands and other hardware with Bitumastic material.
    B. Domestic Water
        1. Copper, Type L, ASTM B88, hard drawn, soft drawn may be used next to

fixtures. Fittings shall be wrought copper, brass or cast bronze. Joints shall be screwed or pressure type with 95/5 solder and non-corrosive flux.
Lead free requirements: Potable water pipes and fittings with lead content must not exceed 0.25 percent lead in the wetted surface material. Solder and flux for potable water systems shall contain less than 0.2 percent lead.

4. Valves
   A. Acceptable Manufacturers
      1. Standard Industrial Valves: Stockham, Crane, Nibco, ITT Grinnell.
      2. Ball Valves: Apollo, Crane, Nibco, ITT Grinnell.
      3. Non-Slam Check Valves: Clow, Technocheck, Metraflex.
   B. Plumbing
      1. Ball Valves - 3 Inch and Smaller: "Apollo" Series 70 ball valve, bronze body, blow-out proof stem, chrome-plated ball, balancing stop, reinforced Teflon seals and seats and extended stem to accommodate insulation. Ball valves may be used in lieu of gate valves.
      2. Gate Valves - 2 1/2 Inch and Larger: 125 lb. iron body, bronze mounted, flanged ends, Stockham Fig. G-623.
      3. Check Valves - 2 Inch and Smaller: 125 lb. bronze, screwed ends, swing check, Stockham Fig. B-319.
      4. Check Valves - 2 1/2 Inch and Larger: 125 lb. iron body, bronze mounted, flanged ends, renewable disc, Stockham Fig. G-931.
      5. Non-Slam Check Valves - 2 1/2 Inch and Smaller: 125 lb., Buna-N inserts, Clow Figure 329.

22 07 00 INSULATION

1. General
   A. Insulation shall have composite fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 225 and UL 723 not exceeding flame spread of 25 and smoke developed of 50.
   B. Cover piping with premolded fiberglass insulation, having an all-purpose vapor barrier jacket. Cover fittings, valves and flanges with preformed rigid sectional fiberglass insulation. Fill voids with insulating cement and cover insulation with 1/4 inch thick layer of finishing cement and vapor barrier mastic. Valves and fittings 2 1/2 inch size and smaller may be covered with insulating cement built up in 1/2 inch layers to thickness of insulation on piping and finished with finishing cement and mastic. At Contractor's option, install PVC covers, equal to 25/50 Zeston, over inserts of fiberglass insulation. For cold piping, provide vapor barrier protection for all insulation.
2. Domestic Cold Water, Hot Water: 1-inch thick fiberglass.
3. Horizontal Rainwater Piping and Roof Drain Bodies: 1/2-inch thick fiberglass.

22 10 00 PLUMBING

1. Disinfecting Domestic Water System: Disinfect water supply system in accordance with governing codes and local Department of Health regulations.
2. Test all piping systems in accordance with governing authorities, in presence of authorized representative of Owner. Submit two copies of test certificates to Engineer.

3. Cold Water Service: Provide cold water piping from point of existing piping to serve plumbing fixtures and domestic water heaters.
4. Sanitary Sewage: Connect sanitary waste piping to existing sewage system. Verify exact location and invert elevation of existing piping.
5. Floor Drains and Trench Drains: Josam, Wade, Zurn, or J.R. Smith. Equal to Josam Series 30000-A, with nickel bronze top. For drains above grade, provide lead flashing sheet or Chloraloy waterproofing membrane.
6. Cleanouts: Josam, Wade, Zurn or J.R. Smith. Floor cleanouts equal to Josam Series 56000, with nickel bronze top. Wall cleanouts Josam #58600-4, with chrome top.
7. Domestic Water Heater: Refer to Plumbing Materials List on the drawings for plumbing equipment types and requirements.
8. Provide plumbing rough-ins for all plumbing fixtures where shown on the drawings.
9. Plumbing Trim: Furnished and installed by Mechanical unless otherwise noted. Refer to architectural drawings for schedules.
10. Plumbing Fixture Schedule:
    A. Refer to Plumbing Material List on drawings for plumbing fixture types & requirements.
    B. Installation
        1. Caulk around top and sides of all fixtures with silicone type sealant, Dow Corning #786.
        2. Provide reinforcing material as required in all partitions not sufficient in themselves to support plumbing fixtures.
        3. Provide supplies to all fixtures with (loose key) (wheel handle) stop valves.
        4. Exposed piping in finished rooms shall be chrome plated brass.
11. Disinfect domestic water supply system in accordance with governing authorities.
12. Gas Piping: Extend gas piping from existing system as shown. Provide gas pressure regulator and shut-off valve at each item of equipment requiring gas. Paint gas piping exposed to weather and where located in wet spaces with two coats of corrosion resistant paint.

220500 TESTING AND BALANCING

1. Balance control valves to GPM noted on drawings.

END OF SECTION

DIVISIONS 23 - MECHANICAL

23 00 00 GENERAL PROVISIONS

1. General Conditions of the Contract for Construction, AIA A201, and Division 1 shall be part of this contract.
2. Articles contained in the Mechanical and Architectural Specifications may amend, modify, supersede, void or supplement the Articles of the General Conditions, and shall take precedence over the provisions of the General Conditions where differences occur.
3. Provide all work and materials as required herein and on drawings in full accordance with National, State and local Codes, Ordinances and/or regulations having jurisdiction over work.
4. Furnish all labor and materials to provide a complete, functioning installation including plumbing, heating, ventilating, air conditioning, fire protection and temperature control as shown on the drawings and specified herein. All systems shall be complete and shall function to the satisfaction of the Owner and the Engineer upon completion of the Project.
5. Take out all necessary permits, licenses and certificates and pay all fees connected therewith.
6. Visit the site and become familiar with all conditions surrounding the work.
7. Drawings are diagrammatic and intended to show approximate locations unless specifically dimensioned. Coordinate work with existing conditions and other trades to avoid interference.
8. Do all cutting and patching required to install any portion of the mechanical work. Patch with new materials of the same types that were removed. Refinish patched surfaces to match existing adjacent surfaces. Roof penetrations and patching shall be performed by the General Contractor, but at the expense of the Mechanical Contractor.
9. Submit shop drawings for all equipment and material furnished under this contract.
10. Substitutions of equipment other than the types and makes specified in the base design shall be done only by approval, in advance, from the Engineer. Written requests for substitutes of material and equipment must be submitted through a bidding contractor and received by the Engineer no later than ten (10) calendar days prior to bid opening.
11. Touch up or refinish the factory finish of equipment marred during shipment or installation.
12. At the completion of the work, Contractor shall remove all rubbish, dirt and stains caused by his work and shall thoroughly clean all mechanical work including equipment, appliances, fixtures, ductwork, piping, etc.
13. Record Drawings: As work progresses, record all changes and deviations from the contract documents on a set of construction drawings, including underground and concealed aboveground piping and ductwork. Upon completion of contract, turn over this set of drawings to the Engineer.
14. Guarantee: Contractor shall guarantee all work and materials for a period of one (1) year. Defects of any kind due to faulty work or materials appearing during the above-mentioned period must be immediately made good by the Contractor at his own expense to the entire satisfaction of the Owner. Such reconstruction and repairs shall include all damage to the finish or furnishings of the building resulting from the original defect or repairs thereto.
15. Operation and Maintenance Manuals: Assemble and transmit to the Owner two (2) combined sets of shop drawings, manufacturer bulletins and other data as required covering the care, maintenance, and operation of each piece of equipment furnished, including at a minimum – equipment capacities and required maintenance actions; all manufacturer published O&M documents; HVAC system control maintenance and calibration information, including wiring diagrams, schematics and control sequences of operation, programmed set points; and a

complete narrative of how equipment is intended to operate.

16. Start-up and Owner Training: The operating personnel shall be fully instructed by the Contractor in the operation of each mechanical system before acceptance of the work. Training records shall be signed by the instructor and each person receiving training, and submitted to the Owner's representative prior to project close-out. Training sessions shall be recorded in DVD format and turned over to the owner.

23 07 00 INSULATION

1. General
   A. Insulation shall have composite fire and smoke hazard ratings as tested by Procedure ASTM E-84, NFPA 225 and UL 723 not exceeding flame spread of 25 and smoke developed of 50.
   B. Cover piping with premolded fiberglass insulation, having an all-purpose vapor barrier jacket. Cover fittings, valves and flanges with preformed rigid sectional fiberglass insulation. Fill voids with insulating cement and cover insulation with 1/4 inch thick layer of finishing cement and vapor barrier mastic. Valves and fittings 2 1/2 inch size and smaller may be covered with insulating cement built up in 1/2 inch layers to thickness of insulation on piping and finished with finishing cement and mastic. At Contractor's option, install PVC covers, equal to 25/50 Zeston, over inserts of fiberglass insulation. For cold piping, provide vapor barrier protection for all insulation.
   C. External insulation where ductwork is exposed shall be rigid fiberglass board, minimum 4.2 pcf density and with FSK jacket.
   D. External insulation where ductwork is concealed shall be fiberglass blanket, minimum 1 pcf density and with FSK jacket.
2. Exposed Rectangular Outside Air Ductwork: 1 1/2-inch thick fiberglass rigid duct-board; 3-inch thick fiberglass blanket where concealed.
3. Exposed supply air and return air ductwork: Uninsulated.
4. Exposed rectangular exhaust and relief air ductwork within 10 ft. of exterior wall or roof: 1-inch thick fiberglass duct-board. 2-inch thick fiberglass blanket where concealed.

23 05 00 TESTING AND BALANCING

1. Balance air systems to produce air volumes noted on drawings. Submit schedule to Engineer in PDF, containing the following information: Room number, grille, register or diffuser size, specified CFM, actual CFM, volume of air handled by each fan, static pressure across each fan, speed of fans and motors, rated motor amperages, actual motor amperages.

23 09 00 AUTOMATIC TEMPERATURE CONTROL

1. General:
   A. Provide standalone control for all equipment.
2. Products:
   A. Acceptable Manufacturers: Honeywell or Approved Equal.
   B. Electric Thermostats: Low voltage room thermostats with locking covers and concealed setpoints. Thermostats shall be 7-day programmable with automatic switchover between Heat/Cool/Off for temperature control and Auto/Off for fan control.
   C. Electrical Wiring: Control wiring in connection with temperature control system shall

be provided by this Contractor. Power wiring will be provided under Electrical.

23 30 00 HEATING, VENTILATING & AIR CONDITIONING

1. Ductwork
   A. Construct all ductwork in accordance with ASHRAE and SMACNA standards. Extend ductwork substantially as shown on drawings with bends and curves of easy radius. Install adjustable quadrant dampers in all branch ducts. Seal all ductwork in accordance with SMACNA standards: above 2 inch W.G. static pressure - Seal Class "A"; between 1 inch and 2 inch W.G. - Seal Class "B"; less than 1 inch W.G. - Seal Class "C". Duct sizes shown on drawings are inside dimensions. Increase as necessary to accommodate duct lining where specified.
   B. Corrosion resistant ductwork shall be fabricated from Type 316L stainless steel, minimum 16- gauge sheet with a #3 finish. Duct reinforcements and supports shall be of stainless steel. All fasteners shall be cadmium plated or stainless steel.
   C. Provide UL approved flexible connections at inlet and outlet of each fan.
   D. Provide duct hangers and supports in accordance with current SMACNA standards.
2. Provide UL labeled fire dampers where shown, mounted in accordance with NFPA 90A.
3. Grilles, Registers and Diffusers – as scheduled on drawings.
   A. Manufacturers: Anemostat, Titus, Krueger, Tuttle & Bailey.
   B. Return and Exhaust Grille, Lay-in Ceiling: Anemostat, Titus, Krueger, Tuttle & Bailey.
   C. Exhaust Register: Anemostat, Titus, Krueger, Tuttle & Bailey.
   D. Sidewall Supply Register: Anemostat, Titus, Krueger, Tuttle & Bailey.
4. Electric Cabinet Unit Heater: Markel, Berko, Airtherm or approved equal.
   A. Electric cabinet unit heater as scheduled on the drawings. Heater shall be of the recessed or semi-recessed architectural type and shall be complete with heavy gauge steel cabinet with standard manufacturers enable paint, unit mounted disconnect, wall mounting bracket, safety controls and unit mounted thermostat.
5. Electric Unit Heater: Trane, Chromalox, Berko, Markel.
   A. Electric unit heater as scheduled on the drawings. Heater shall be complete with unit mounted disconnect, wall mounting bracket, safety controls and unit mounted thermostat.
6. Exhaust Fans: TC Fan, Greenheck, Cook, Acme, Jenn-Air or Penn are acceptable.
   A. Power Roof Ventilators: Equal to Greenheck Model G (direct drive) or Model GB (belt drive), removable spun aluminum dome with square one-piece aluminum base and curb cap with venturi inlet cone, aluminum centrifugal fan with backward inclined or airfoil blades, ECM motor or VFD, disconnect switch, motorized damper and extended base, aluminum bird screen. Provide insulated prefabricated roof curb.
7. Split System Heat Pump with Condensing Unit (HP / CU): LG Electronics or Approved Equal.
   A. Provide packaged, air-cooled, factory assembled, pre-wired and pre-piped unit consisting of cabinet, fans, filters, remote condensing unit, and controls. Wall-mounted units shall be furnished with integral wall mounting bracket and mounting hardware.
   B. Refrigeration System:
      1. Direct expansion cooling coil.
      2. Hermetically sealed compressor with internal spring isolation, external isolation, permanent split capacitor motor and overload protection.

3. Accumulator.
4. Condenser coil and fan.
5. Coaxial tube in tube condenser with water regulating valve.
6. Capillary restrictor and constant pressure expansion valve.
7. Reversing valve.

C. Outdoor Unit.

1. The outdoor unit shall be specifically matched to the corresponding indoor unit size. The outdoor unit shall be completely factory assembled and pre-wired with all necessary electronic and refrigerant controls.
2. The outdoor unit shall be fabricated of galvanized steel, bonderized and coated with a baked enamel finish for corrosion protection.
3. The fan shall be direct drive, propeller type fan with fan guard.
4. Outdoor coil shall be nonferrous construction with corrugated fin tube.
5. Hermetic or scroll refrigerant compressors with resilient suspension system, oil strainer, sight glass/moisture indicator, internal motor protection, high pressure switch, and crankcase heater.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. OSHPD - Office of State Wide Health Planning and Development (California)

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make his portion of the Electrical Work a finished and working system.

C. Description of Systems shall be as follows:

1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
2. Grounding system.
3. Wiring of equipment furnished by others.
4. Removal work and/or relocation and reuse of existing systems and equipment.

1.4 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

1.5 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, & CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
2. Motor Power Wiring: The single phase or 3 phase wiring extending from

the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.

3. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
4. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.
5. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
6. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
7. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Code of

Regulation Title 24, Article E725.

D. Mechanical Contractor's Responsibility:
   1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
   2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
   3. Assumes all responsibility for Temperature Control wiring, if Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
   4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor or Subcontractor Responsibility:
   1. Wiring of all devices needed to make Temperature Control System functional.
   2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
   3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:
   1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
   2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
   3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
   4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
   5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.6 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:
   1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include

imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.

2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:
1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:
1. Conform to all requirements of the City, State of Michigan Codes, Laws, and local Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, any parts of the drawings or specifications that do not comply with the codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, he shall submit with his proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the NEC shall be followed.

D. Permits, Fees, Taxes, Inspections:
1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:
1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:
1. Construction drawings for project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.

4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:
1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.7 SUBMITTALS

A. Submittals shall be required for all major pieces of equipment as stated within individual specifications.

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:
1. Transmittal: Each transmittal shall include the following:
a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data
2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:
a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:
   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.
4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor Approval Stamp:
   a. Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
   b. Unstamped submittals will be rejected.
   c. The Contractor’s review shall include, but not be limited to, verification of the following:
      1) Only approved manufacturers are used.
      2) Addenda items have been incorporated.
      3) Catalog numbers and options match those specified.
      4) Performance data matches that specified.
      5) Electrical characteristics and loads match those specified.
      6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
      7) Dimensions and service clearances are suitable for the intended location.
      8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
      9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).
   d. The Contractor shall review, stamp, and approve all subcontractors’ submittals as described above.
   e. The Contractor’s approval stamp is required on all submittals.
6. Submittal Identification and Markings:
   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
   b. The Contractor shall clearly indicate the size, finish, material, etc.

c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor’s responsibility for errors, omissions, or deviation from the contract documents in submittals is not relieved by the Architect/Engineer’s approval.

C. Electronic Submittal Procedures:
1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
a. Submittal file name: 26 XX XX.description.YYYYMMDD
b. Transmittal file name: 26 XX XX.description.YYYYMMDD
5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

D. Paper Copy Submittal Procedures:
1. Paper copies are acceptable where electronic copies are not provided.
2. The Contractor shall submit ten (10) paper copies of each shop drawing.

3. Each set shall be bound in a three-ring binder or presentation binder. Copies that are loose or in pocket folders are not acceptable.

1.8 PRODUCT DELIVERY, STORAGE, HANDLING AND MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Keep all materials clean, dry and free from damaging environments.

C. Coordinate the installation of heavy and large equipment with General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate his/her work with other trades.

1.9 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.10 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.11 CONTINGENCY

A. Include in the Base Bid a contingency of one percent (1%) to be used only by change orders issued by the Architect/Engineer. The unused portion of the contingency shall be deducted from the Contract price before final payment is made.

1.12 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis of design and establishes the quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be

used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications, and fit in the allocated space. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on his part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on his part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, contactors, motor starters,) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor

shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.

2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with his work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.
9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review <u>all</u> Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate,

or perform extra work as directed by the Architect/Engineer.

D. Fill and Backfilling:
   1. No rubbish or waste material is permitted for fill or backfill.
   2. Furnish all necessary sand for backfilling.
   3. Dispose of the excess excavated earth as directed.
   4. Backfill materials shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
   5. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
   6. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
   7. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
   8. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.
   9. Backfill with sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of conduit.
   10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
   11. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
   12. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

E. Surface Restoration:
   1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
   2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:
   a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
   b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
   c. Luminaire whips are supported above the ceiling.
   d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
   e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
   f. All wall penetrations have been sealed.
2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. IDPH Pre-Occupancy Requirements:

1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.

C. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 48 ___ hours prior to installation of ceilings or lay-in ceiling tiles.

D. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop

drawings.

2. Record documents including marked-up drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed by owner.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

E. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.
   a. O&M file name: O&M.div26.contractor.YYYYMMDD
   b. Transmittal file name:

O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:
1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER REPRESENTATIVE

A. Adequately instruct the Owner designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The instructions shall include:
   1. Maintenance of equipment.
   2. Start-up procedures for all major equipment.
   3. Description of emergency system operation.

D. Notify the Architect/Engineer of the time and place for the verbal instructions to the Owner's representative so his representative can be present if desired.

E. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

F. Operating Instructions:
   1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
   2. If Contractor does not have staff that can adequately provide the required instructions, he shall include in his bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

A. The following paragraphs supplement the requirements of Division 1.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

A. This Contractor shall paint the following items:

B. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of

paint applied unless specifically allowed to be provided with a prime coat only.

C. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, he shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

D. Equipment cabinets, casings, covers, metal jackets, etc., located in equipment rooms or concealed spaces, shall be furnished in standard finish, free from scratches, abrasions, chippings, etc.

E. Equipment in occupied spaces, or if standard to the unit, shall have a baked primer with baked enamel finish coat free from scratches, abrasions, chipping, etc. If color option is specified or is standard to the unit, verify with the Architect his color preference before ordering.

F. Paint all equipment in unfinished areas such as boiler room, mechanical spaces, and storage rooms. Equipment furnished with a suitable factory finish need not be painted; provided the factory applied finish is not marred or spattered. If so, equipment shall be refinished with the same paint as was factory applied.

G. All electrical conduit and equipment, fittings, hangers, structural supports, etc., in unfinished areas, such as equipment and storage room area, shall be painted two (2) coats of oil paint of colors selected by the Architect.

H. Do NOT paint electric conduits in crawl spaces, tunnels, or spaces above suspended ceilings except that where conduit is in a damp location give exposed threads at joints two coats of sealer after joint is made up.

I. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.
3. Color of paint shall be as follows:

J. In accordance with LEED EQc4.2: Low-Emitting Materials - Paints and Coatings, all paints and coatings used on the interior of the building must comply with the following criteria:

1. Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) content limits established in Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.
2. Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limit of 250 g/L (2 lb./gal) established in Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

3.9 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. erect and maintain dust barriers throughout the construction work. Barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.
   A. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or

elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.

B. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
C. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
D. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
E. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.
F. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:
   A. Minimizing the amount of dust generated.
   B. Reducing solvent fumes and VOC emissions.
   C. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.
4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.12 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of

electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.13 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester’s name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than NEC Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional

ohmmeter is not an acceptable device.)

2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain.
3. If the ground resistance value obtained is more than the value set forth in Section 26 05 26, the following shall be done to obtain the value given:
   a. Verify all connections in the service ground system are secure.
   b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
   c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
   d. Review results with the Architect/Engineer.
4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:
   a. Date of test.
   b. Number of hours since the last rain.
   c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
   d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
   e. Make, model, and calibration date of test equipment.
   f. Tabulation of measurements taken and calculations made.

C. Other Equipment:
1. Give other equipment furnished and installed by Contractor all standard tests normally made to assure the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

D. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

E. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.

F. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

G. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.14 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items

completed. Rebate may include lighting, lighting controls, variable speed drives, , programmable thermostats, and motors.

END OF SECTION

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 05 00, cable insulation test results have been submitted.
5. Per Section 26 05 00, medium voltage testing report has been submitted.
6. Per Section 26 05 00, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 05 00.
8. Bound copies of approved shop drawings have been submitted as per Section 26 05 00.
9. Report of instruction of Owner representative has been submitted as per Section 26 05 00.
10. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 & 28 31 00.
11. Start-up reports from factory representative have been submitted as per Section 26 05 00.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

* * * * * *

SECTION 26 05 05 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-penetration firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: company specializing in manufacturing products specified.
B. Installer: individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - fire tests of building construction and materials.
B. UL 723 - surface burning characteristics of building materials
C. ANSI/UL 1479 - fire tests of through penetration firestops
D. UL 2079 - tests for fire resistance of building joint systems
E. UL fire resistance directory through penetration firestop systems (XHEZ)
F. Intertek / Warnock Hersey - directory of listed products
G. ASTM e84 - standard test method for surface burning characteristics of building materials
H. ASTM e814 - standard test method for fire tests of through-penetration firestops
I. The building officials and code administrators national building code
J. NFPA 5000 – building construction safety code

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.
B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

A. General: for penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
    1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
    2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.
B. Rated systems: provide through-penetration firestop systems with the following ratings determined per UL 1479:
    1. F-rated systems: provide through-penetration firestop systems with f-ratings indicated, but not less than that equaling or exceeding fire-

resistance rating of constructions penetrated.

2. T-rated systems: for the following conditions, provide through-penetration firestop systems with t-ratings indicated, as well as f-ratings:
   a. Floor penetrations located outside wall cavities.
   b. Floor penetrations located outside fire-resistance-rated shaft enclosures.
   c. Wall penetrations above corridor ceilings which are not part of a fire-resistive assembly.
   d. Wall penetrations below any ceiling that are larger than 4" diameter or 16 square inches.
3. L-rated systems: provide through-penetration firestop systems with l-ratings of not more than 5.0 cfm/sq.ft. (0.0254 cu. M/s x sq. M) at both ambient temperature and 400°f (204°c) for smoke barriers.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM e 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM e 84.

F. Adhesives and sealants: all sealers, adhesives, and sealants shall comply with the low emitting material limits.

1.6 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.
   1. 3M; fire protection products division
   2. HILTI, inc.
   3. Rectorseal corporation, Metacaulk
   4. Tremco; sealant/weatherproofing division

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey

to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCBs, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey fire resistance directory category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible framed floors and chase walls - 1 or 2 hour rated
   F rating = floor/wall rating
   T rating = floor/wall rating
   L rating = penetrations in smoke barriers
2. Non-combustible framed walls - 1 or 2 hour rated
   F rating = wall rating
   T rating = 0
   L rating = penetrations in smoke barriers
3. Concrete or masonry floors and walls - 1 or 2 hour rated
   F rating = wall/floor rating
   T rating (floors) = floor rating
   L rating = penetrations in smoke barriers

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey fire resistance directory or outlined in manufacturer's information shall be sealed in a manner agreed upon by the firestopping manufacturer, owner, and the authority having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop

system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the authority having jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey fire resistance directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of substantial completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "warning - through penetration firestop system - do not disturb. Notify building management of any damage."
2. Firestop system supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.5 INSPECTION

A. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the architect/engineer and manufacturer's factory representative. The architect/engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor

is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the architect/engineer's discretion and the contractor's expense.

END OF SECTION

SECTION 26 05 13 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire
B. Cabling for remote control, signal, and power limited circuits
C. Fire rated and circuit integrity (CI) cable and assemblies
D. Metal-clad cable (MC)

1.2 RELATED WORK

A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. NEMA WC 70 - Power Cables Rated 2,000V or Less for Distribution of Electrical Energy
B. NFPA 70 - National Electrical Code (NEC)
C. UL 44 – Thermoset-Insulated Wires and Cables
D. UL 83 – Thermoplastic-Insulated Wires and Cables
E. UL 854 – Service-Entrance Cables
F. UL 1581 – Standard for Electrical Wires, Cables, and Flexible Cords
G. UL 2196 – Fire Resistive, Fire Resistant and Circuit Integrity Cables

1.4 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 26 05 00.
B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.
    1. Aluminum conductors shall not be allowed.
B. Feeders and Branch Circuits Larger Than 6 AWG in Underground Conduit: Copper, stranded conductor, 600-volt insulation, XHHW-2.
C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600-volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor, unless otherwise noted on the drawings.
D. Motor Feeder from Variable Frequency Drives: Copper conductor, 600-volt XHHW-2 insulation, stranded conductor, unless otherwise noted on drawings.
E. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.
F. Each 120-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS:

A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings

or specifications, the system manufacturer's recommendations shall be followed.

1. Fire alarm
2. Low voltage switching

B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.

C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60ºC, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.3 FIRE-RATED AND CIRCUIT INTEGRITY (CI) CABLE AND ASSEMBLIES

A. Properties and requirements of fire-rated cables and assemblies:

1. 2HR fire-rated for horizontal and vertical installation.

B. Acceptable fire-rated cables and listed assemblies:

1. Feeder assembly located outside the structure (example: below finished grade). Rated metal stud and drywall enclosure, or encased in concrete: minimum 2 inches of concrete).
2. MC Cable: Copper conductor, 600V thermosel, low smoke zero halogen silicone rubber insulation, continuously welded corrugated copper armor for equipment grounding conductor, rated 90°C, UL listed 2196. MC fire-rated cable shall not be used for branch circuits that require redundant equipment ground paths per code.
3. Fire-rated cable in EMT or IMC raceway: Copper conductor, 300V or ethernet power-limited circuit cables low smoke zero halogen (LSZH), rated 105°C. Assembly including raceway shall be UL listed 2196 and UL circuit integrity (FHIT).
    a. Manufacturers:
        1) BITALINK CI/CIC or ethernet series
        2) Draka RHW-2 EMT series

2.4 METAL-CLAD CABLE (MC)

A. Conductors shall be copper, 600V insulation, THHN. Metal clad cable shall be constructed in strict accordance with Underwriters Laboratories, Inc. Standard for Metal-Clad Cables, UL 15694, exterior of metal interlocked armor.

B. Minimum conductor size for branch circuit wiring shall be 12 AWG, with larger wires used where specified.

C. Metal-clad cables may be used for branch circuit wiring as defined in the Electrical Code, subject to acceptance by State and local codes. Metal-clad cables shall not be used for home runs.

D. Metal-clad cable shall NOT be used for circuit service Essential Electrical System.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:
   1. Building wire shall be installed in raceway.
B. All Other Locations: Building wire in raceway.
C. Above Grade: All conductors installed above grade shall be type "THHN".
D. Underground or In Slab: All conductors shall be type "THWN".
E. Fire-Rated 2-Hour Feeders and Circuit Requiring Continuous Operation (CI): Refer to Part 2 of this section for acceptable products and assemblies. Installation shall meet UL 2196.

3.2 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.15(B)(16) (formerly 310.16 for NEC 2008 and earlier). Service entrance conductors are based on copper conductor installed in underground electrical ducts, NEC Table B.310.15(B)(2)(7) (formerly B.310.7 for NEC 2008 and earlier).
B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.
C. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.
B. Use no wire smaller than 18 AWG for low voltage control wiring (<100 volts).
C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.
D. Use no wire smaller than 8 AWG for outdoor lighting circuits.
E. The ampacity of multiple conductors in one conduit shall be derated per NEC 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.
G. Splice only in junction or outlet boxes.
H. Neatly train and lace wiring inside boxes, equipment, and panelboards.
I. Make conductor lengths for parallel circuits equal.
J. All conductors shall be continuous in conduit from last outlet to their termination.
K. Terminate all spare conductors on terminal blocks, and label the spare conductors.
L. Cables or wires shall not be laid out on the ground before pulling.
M. Cables or wires shall not be dragged over earth or paving.
N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:

1. Support conductors in vertical raceways in accordance with NEC 300.19 and Table 300.19(A) Spacing of Conductors Supports.
2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.5 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:
   a. Left to Right - A-B-C
   b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. Inspect wire and cable for physical damage and proper connection.

D. Torque test conductor connections and terminations to manufacturer's recommended values.

E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

F. Protection of wire and cable from foreign materials:

1. It is the Contractor responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

G. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 26 05 26 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Equipment grounding system

1.2 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

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 UL 467 Grounding and Bonding Equipment.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with NFPA 70; for overhead-line construction & medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.3 REFERENCES

A. NFPA 70 – National Electrical Code (NEC)

1.4 SUMMARY

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section 26 05 13 "Wire and Cable".

B. Material: Copper

C. Equipment Grounding Conductors: Insulated. Refer to Section 26 05 53 for insulation color.

D. Isolated Ground Conductors: Insulated. Refer to Section 26 05 53 for insulation color.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Connectors: Hydraulic compression type, and selected per manufacturer's written instructions.

C. Bolted Connectors: Bolted-pressure-type connectors.

PART 3 - EXECUTION

3.1 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against

moisture penetration of insulation and cable.

3.2 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

B. In raceways, use insulated equipment grounding conductors.

3.3 EQUIPMENT GROUNDING SYSTEM

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
2. Single-phase and three-phase motor and appliance branch circuits.
3. Flexible raceway runs, including FMC and LFMC.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.4 BONDING SYSTEM

A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.

B. Exterior Metallic Pull and Junction Box Covers: Bond to grounding system using flexible grounding conductors.

3.5 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

SECTION 26 05 27 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and equipment supports
B. Fastening hardware
C. Concrete housekeeping pads

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 COORDINATION

A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Allied Support Systems
B. Cooper B-Line
C. Erico, Inc.
D. Hilti
E. Power Fasteners
F. Orbit Industries

2.2 MATERIAL

A. Support Channel: Hot-dip galvanized stainless steel for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.
B. Hardware: Corrosion resistant.
C. Anchorage and Structural Attachment Components:
    1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.
        a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.
    2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
    3. Welding Lugs: Comply with MSS-SP-69, Type 57.
    4. Beam clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.
    5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings and matched to the type and size of anchor bolts and studs used.
    6. Bushing Assemblies for Wall-Mounted Equipment Anchorage:

Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings and matched to the type and size of attachment devices used.

7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-05. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:
1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Fabricate all lintels from structural steel shapes or as indicated on drawings.
3. Fabricate all sleeves from standard weight black steel pipe. Provide continuous sleeve. Cut or split sleeves are not acceptable. Sleeves through concrete walls may be high density polyethylene pipe penetration sleeve with a water stop collar, suitable for use with Link-Seal mechanical seals. Century-Line Model CS.
4. Sleeves through the floors on exposed risers shall be flush with the ceiling, with planed squared ends extending 1" above the floor in unfinished areas, and flush with the floor in finished areas, to accept spring closing floor plates.
5. Sleeves shall not penetrate structural members without approval from the Structural Engineer.
6. Install all sleeves concentric with conduits. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.
7. Where conduits rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (asphalt and cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.
8. Size sleeves large enough to allow expansion and contraction movement.

E. Concrete Housekeeping Pads:
1. Concrete bases for all floor mounted equipment and wall mounted equipment which is surface mounted and extends to within 6" of the finished floors, unless shown otherwise on the drawings, shall be 3-1/2" thick concrete.
2. Bases shall extend 3" on all sides of the equipment (6" larger than factory base).
3. Where the base is less than 12" from a wall, the base shall be carried to the wall to prevent a "dirt-trap".
4. Concrete materials and workmanship required for the Contractor's work shall be provided by him. Materials and workmanship shall conform to the applicable standards of the Portland Cement Association. Reinforce with 6” x 6”, W1.4-W1.4 welded wire fabric. Concrete shall withstand

3,000 pounds compression per square inch at twenty-eight days.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

C. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

D. Do not use powder-actuated anchors without specific permission.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

G. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

H. Install cabinets and panelboards with minimum of

I. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

J. Do not exceed 25 lbs. per hanger and a minimum spacing of 2′-0″ on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2′-0″ spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

K. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1″ of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6′-6″ of finish floor and presents potential injury to personnel.

END OF SECTION

SECTION 26 05 33 - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)
B. Stainless steel conduit (316SS) and fittings
C. Intermediate metallic conduit and fittings (IMC)
D. Electrical metallic tubing and fittings (EMT)
E. Flexible metallic conduit and fittings (FMC)
F. Liquidtight flexible metallic conduit and fittings (LFMC)
G. Rigid polyvinyl chloride conduit and fittings (PVC)
H. Wall and ceiling outlet boxes
I. Electrical connection
J. Pull and junction boxes
K. Accessories

1.2 RELATED WORK

A. Section 26 05 53 – Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
   2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
   3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
   4. ANSI C80.6 – Intermediate Metal Conduit, Zinc Coated
   5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
B. Federal Specifications (FS):
   1. A–A–50553A – Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
   2. A–A–55810 – Specification for Flexible Metal Conduit
C. NECA “Standards of Installation”
D. National Electrical Manufacturers Association (NEMA):
   1. ANSI/NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
   2. RN 1 – Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, and Intermediate Metal Conduit
   3. TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit
   4. TC 9 – Fittings for PVC Plastic Utilities Duct for Underground Installation
E. NFPA 70 – National Electrical Code (NEC)
F. Underwriters Laboratories (UL): Applicable Listings
   1. UL 1 – Flexible Metal Conduit
   2. UL 6 – Rigid Metal Conduit
   3. UL 360 – Liquid Tight Flexible Steel Conduit
   4. UL514-B – Conduit Tubing and Cable Fittings

5. UL651-A – Type EB and a PVC Conduit and HDPE Conduit
6. UL651-B – Continuous Length HDPE Conduit
7. UL797 – Electrical Metal Tubing
8. UL1242 – Intermediate Metal Conduit

G. American Standard of Testing and Materials (ASTM):
1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

H. Definitions:
1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Acceptable Manufacturers:
1. Acceptable Manufacturers: Allied, LTV, Steelduct, Calbond Calpipe, Wheatland Tube Co, O-Z Gedney, or approved equal.
2. Acceptable Manufacturers of RMC Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Crouse-Hinds, Killark, Orbit Industries or approved equal.

B. Minimum Size Galvanized Steel: 3/4 inch (19mm), unless otherwise noted.

C. Fittings and Conduit Bodies:
1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type

with provisions for mounting to form.

2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

D. PVC Externally Coated Conduit: Compliant with NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system. Acceptable Manufacturers: Calbond Calpipe, Robroy, T&B Ocal or approved equal.

2.2 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers: Allied, LTV, Steelduct, Wheatland Tube Co, O-Z Gedney, or approved equal.

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers of EMT Conduit: Allied, Calbond Calpipe, LTV, Steelduct, Wheatland Tube Co, or approved equal.

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.

2. Larger than 2": Compression type of steel designed for their specific application.
3. Acceptable Manufacturers of EMT Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, Orbit Industries or approved equal.

2.4 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.

B. Acceptable Manufacturers: American Flex, Alflex, Electri-Flex Co, or approved equal.

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:
1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Acceptable Manufacturers: O-Z/Gedney Co., Thomas & Betts, Appleton Electric, Electroline, Bridgeport, Midwest, Regal, Orbit Industries, or approved equal.

2.5 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Acceptable Manufacturers: Anaconda Type UA, Electri-Flex Type LA, Alflex, Carlon (Lamson & Sessions), or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:
1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Acceptable Manufacturers: Appleton Electric, O-Z/Gedney Co., Electroline, Bridgeport, Thomas & Betts, Midwest, Regal, Carlon (Lamson & Sessions), Orbit Industries, or approved equal.

2.6 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers: Carlon (Lamson & Sessions) Type 40, Cantex, J.M. Mfg., or approved equal.

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.7 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, minimum of 14 gauge, with 1/2-inch male fixture studs where required.
B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.
C. Cast Boxes: NEMA FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.
D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.
E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.
F. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.
G. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.8 ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per NEC. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.9 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.
B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.
C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
E. Flanged type boxes shall be used where installed flush in wall.

2.10 ACCESSORIES

A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control – IsoBacker Pad, SpecSeal – SSP Putty and Pads, 3M #MPP-4S or equal.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the NEC shall be required.

B. Site Conduits:

1. Within 5' from the Perimeter of a Building Foundation: PVC conduit with a minimum of 3" thickness between the surface of the concrete and the nearest conduit. Concrete to be doweled into the foundation.
2. 5' or Greater from the Perimeter of a Building Foundation: PVC.

C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to NEC. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the NEC (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

D. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)

E. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness.

Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.

2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines & walls.

D. Conduit shall not share same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt his work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by him. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

B. Conduit shall <u>not</u> be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Arrange supports in vertical runs so the weight of raceways and enclosed

conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

H. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the NEC requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

I. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

J. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the NEC requirements.

K. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

L. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will <u>not</u> be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4)

quarter bends (360°), including those bends located immediately at the outlet or body.

4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.
   a. A third bend is acceptable if:
      1) The total run is not longer than (33) feet.
      2) The conduit size is increased to the next trade size.
5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:
1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the NEC.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.
5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT EXPENSE OF CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units,

coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, equal to O-Z/Gedney type EYD.

9. Horizontal conduit routing through slabs above grade
   a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
   b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
   c. No conduits are allowed to be routed horizontally through slabs above grade.
10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.

3.5 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the NEC, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

A. Conduit shall be installed away from high temperature piping and equipment.

B. Conduit shall be installed to prevent exposure to ultraviolet radiation.

C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.

D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.

E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the NEC, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

3.7 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (>600V) and 18 inches for secondary conduits (<600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater

than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.

3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit he shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

E. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

F. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.

3.8 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8’ above the highest platform level.

B. Cast boxes shall be used in:

1. Exterior locations.
2. Exposed interior locations within 8’ of the highest platform level.
3. Direct contact with earth.
4. Direct contact with concrete in slab on grade.
5. Wet locations.

3.9 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.
C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.
D. Locate and install to maintain headroom and to present a neat appearance.
E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.10 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls.
B. Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)
C. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.
D. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
E. Provide knockout closures for unused openings.
F. Support boxes independently of conduit.
G. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
H. Install boxes in walls without damaging wall insulation.
I. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.
J. Position outlets to locate luminaires as shown on reflected ceiling drawings.
K. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.11 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes & junction boxes above accessible ceilings or in unfinished areas.
B. Support pull and junction boxes independent of conduit.
C. Do not install boxes back-to-back in walls.

3.12 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.
B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported

with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

END OF SECTION

SECTION 26 05 35 - SURFACE RACEWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Surface metal raceways
B. Surface non-metallic raceways

1.2 REFERENCES

A. FS W-C-582 - Conduit, Raceway, Metal, and Fitting; Surface

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 26 05 00.
B. Include product data for surface metal raceways, surface non-metallic raceways, auxiliary gutters, and accessories.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL SURFACE RACEWAY

A. Surface Metal Raceway: Steel channel with fitted cover,
B. Finish: Color selection by Architect.
C. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
D. Boxes and Extension Rings: Designed for use with the raceway system.
E. Approved Manufacturers: Wiremold V500/V700 series, Mono-Systems SMS500/SMS700 series, Hubbell HBL500/HBL700 series.

2.2 SURFACE METAL RACEWAY

A. Surface Metal Raceway: FS W-C-582; sheet metal channel with fitted cover, suitable for use as a continuous surface metal raceway.
B. Finish: Coordinate paint color with Architect.
C. Fittings: Couplings, elbows, and connectors designed for use with raceway system.
D. Boxes and Extension Rings: Designed for use with raceway systems.

2.3 SURFACE NON-METALLIC RACEWAY

A. Surface Non-Metallic Raceway: Polyvinyl chloride channel with fitted cover; UL listed for power conductors.
B. Length: As shown on the drawings.
C. Finish: color selected by Architect.
D. Fittings and Accessories: Couplings, elbows, outlet and device boxes, and connectors designed for use with the raceway system.
E. Coverplates shall be same material and finish as raceway.
F. Normal power receptacles shall be same color as raceway. Coordinate color with Architect.
G. Acceptable Manufacturers: Wiremold PN20A Series, Hubbell PW2 Series.

PART 3 - EXECUTION

3.1 INSTALLATION – ARCHITECTURAL SURFACE RACEWAY

A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
B. Maintain grounding continuity between raceway components to provide a continuous grounding path.
C. Fastener: Use clips and straps suitable for the purpose.
D. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer's raceway accessories as needed.
E. Routing and Planning: Coordinate routings with existing vertical/horizontal building lines and features (doorways, wall trim, at wall/ceiling interface, etc.). Match the square / parallel lines of other existing features. Do not route raceway across large open spaces of the wall unless required by the application.

3.2 INSTALLATION - SURFACE NON-METALLIC RACEWAY

A. Use flat-head screws to fasten channel to surfaces. Mount plumb and level.
B. Do not locate raceway near heating elements, open flames or surfaces with a probable temperature greater than 150°F.
C. Do not locate raceway where there is a probability of contact with oils, chemicals or moisture.
D. Contractor shall install a bonded ground conductor the entire length of raceway.
E. Field cuts to be clean and straight and use the proper tools as recommended by the system manufacturer to prohibit damage to factory finish or raceway. Joints to be matched so there are no gaps or spaces in the cover. Furnish and install manufacturer's raceway accessories as needed.
F. Provide conduits to technology raceway per drawings or provide a minimum of one (1) 1-1/4" conduit per six feet of assembly (minimum 2) to above ceiling for technology requirements if assembly has technology raceway (Contractor shall provide quantities of conduits that provide maximum capacity to assembly). Provide conduits equally spaced within entire length of assembly.
G. Provide one (1) 3/4" empty conduit per six feet of assembly (minimum 1) to above ceiling for future power needs. Provide conduits equally spaced within entire length of assembly.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Adhesive labels, markings, nameplates, and signs
B. Wire and cable markers
C. Raceway, box, and wire identification
D. Equipment short circuit current rating (SCCR) labeling
E. Electrical equipment labeling

1.2 REFERENCES

A. ANSI C2 – National Electrical Safety Code
B. NFPA 70 – National Electrical Code (NEC)
C. ANSI Z535.4 – Standard for Product Safety Signs and Labels

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).
   1. Label Size as follows:
      a. Raceways: Kroy or Brother labels 1-inch (25mm) high by 12-inches (305mm) long (minimum).
   2. Color: As specified for various systems.
B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch (25mm) to 2 inches (50mm) in width.

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch (2mm) minimum thick for signs up to 20 square inches (13 square cm), or 8 inches (200mm) in length; 1/8 inch (3mm) thick for larger sizes. Labels shall be punched for mechanical fasteners.
B. Baked–Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.
C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (10mm) galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.
D. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.

B. Install identification devices in accordance with manufacturer's written instruction and requirements of NEC.

C. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

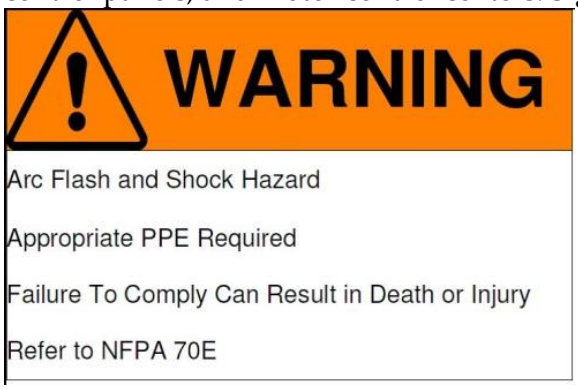
D. Apply warning, caution and instruction signs as follows:

1. Install warning, caution or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

E. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

F. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

G. Install ARC FLASH WARNING signs on all switchboards, panelboards, industrial control panels, and motor control centers. Sign at a minimum shall contain:



3.2 BOX LABELING

A. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch (10mm) Kroy tape or Brother self-laminating vinyl label, letters/numbers color coded same as conduits. In rooms that are painted out, provide labeling on inside of cover.

B. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").
2. For other wiring, indicate system type and description of wiring ("FIRE ALARM NAC #1").

3.3 CONDUCTOR COLOR CODING

A. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

B. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches (76mm) from the termination and spaced at 3- inches (76mm) centers. Tighten to a snug fit, and cut off excess length.

C. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

D. Conductors shall be color coded as follows:

1. 208Y/120 Volt, 4-Wire:
   a. A-Phase – Black
   b. B-Phase – Red
   c. C-Phase – Blue
   d. Neutral – White
   e. Ground Bond – Green
2. Grounding Conductors:
   a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.

END OF SECTION

SECTION 26 05 73 - POWER SYSTEM STUDY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Low voltage distribution system power study.
B. Short-circuit analysis and report.
C. Selective coordination analysis and report.
D. Arc-flash hazard analysis and report.

1.2 RELATED SECTIONS

A. Section 26 05 00 - Basic Electrical Requirements
B. Section 26 24 13 - Switchboards
C. Section 26 24 16 - Panelboards

1.3 SUBMITTALS

A. Analyses shall be performed by an agent authorized by the manufacturer of equipment specified in the related specification sections and shall bear the seal/signature of the licensed Professional Engineer who performed the analysis.
B. Input for the power system study shall be based on the contract documents, with estimated conductor lengths provided by the Electrical Contractor. IMEG will provide a preliminary Power Tools for Windows project file for information, if requested.
C. Documentation of the analyses shall be submitted in a bound booklet format and shall accompany the shop drawing submittals for equipment provided under the related work specification sections. These shop drawings will not be reviewed without this documentation.
D. Power system study project model shall be submitted on electronic media for review and the Owner's operating and maintenance records.

1.4 SCOPE

A. Provide a power system study of the electrical system shown on the plans. The study shall include arc-fault analysis, selective coordination analysis and arc flash hazard analysis.
B. Contractor is required to provide a fully coordinated system. Contractor shall provide overcurrent protective devices with the appropriate models, frame sizes, trip units, etc. as required to provide a selectively coordinated system.

PART 2 - PRODUCTS

2.1 POWER SYSTEMS STUDY

A. Power systems study shall be completed in Power Tools for Windows (PTW) 8.0 or later version or pre-approved equivalent program.

PART 3 - EXECUTION

3.1 SHORT-CIRCUIT ANALYSIS

A. Provide a complete short-circuit analysis from the utility service to and including

the entire building distribution as shown on the drawings.

B. Analysis shall include the entire distribution system from the point of connection to the utility power source to the distribution panels and branch circuit panelboards.

C. Documentation shall be made in one-line diagram form showing the magnitude and location of each calculated fault. Fault current calculations shall be made at the main bus of each switchboard, distribution panel, and branch circuit panel. A summary of the fault currents available shall also be submitted.

3.2 SELECTIVE COORDINATION ANALYSIS

A. Provide a complete selective coordination analysis, comparing time/current curves of the protective devices to be installed to assure complete selectivity between main and downstream devices for code-required branches and branches identified on one-line drawings. Overcurrent protective devices serving the essential electrical system shall selectively coordinate for the period of time that a fault's duration extends beyond 0.1 second.

B. The analysis shall include primary protective device, secondary main switchboard device(s), switchboard branch feeder devices, generator breaker, distribution panel, panelboard main devices, and branch feeder devices.

C. The coordination plots provided shall indicate graphically the coordination proposed for the system on full-size log forms and shall define the types of protective devices selected, together with proposed time dial and pickup settings required. Plots shall include titles, representative one-line diagrams, legend, complete parameters for transformer(s), & complete operating bands for circuit breaker trip devices, fuses, etc.

1. The long-time region of the coordination plots shall designate the pickups required for the circuit breakers.
2. The short-time region shall indicate the magnetizing in-rush and ASA-withstand-transformer parameter, the circuit breaker, short-time and instantaneous trip devices, fuse-manufacturing tolerance bands, significant symmetrical fault currents, etc.
3. Protective device characteristics or operating bands shall be suitably indicated to reflect the actual symmetrical fault currents sensed by device.
4. Drawings and specifications indicate the general requirements for motors, motor-starting equipment, and medium-voltage and low-voltage equipment, but additional specific requirements of equipment furnished shall be determined in accordance with the results of the coordination study.
    a. The study shall include verification of equipment ratings and settings. The Contractor shall keep the study up-to-date with any project changes which affect the study and submit the revised study for review. A final electronic copy shall be submitted with the record drawings.

D. Provide summary table of adjustable overcurrent protective devices settings for the operating and maintenance manual.

3.3 ARC FLASH HAZARD ANALYSIS

A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E-2018, Annex D.

B. The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, unit substations, motor-control centers, panelboards, busway, and splitters) where work could be performed on energized parts.

C. Safe working distances shall be based on the calculated arc flash boundary considering an incident energy of 1.2 cal/cm^2.

D. When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit analysis and coordination study models. Ground overcurrent relays should not be taken into consideration when determining the clearing time when performing incident energy calculations.

E. Short-circuit calculations and the corresponding incident energy calculations for multiple system scenarios must be compared, and the greatest incident energy must be uniquely reported for each equipment location. Calculations must be performed to represent the maximum and minimum contributions of fault current magnitude for all normal and emergency operating conditions. The minimum calculation will assume that the utility contribution is at a minimum and will assume a minimum motor contribution (all motors off). Conversely, the maximum calculation will assume a maximum contribution from the utility and will assume the maximum amount of motors to be operating. Calculations shall take into consideration parallel operation of synchronous generators with the electric utility, where applicable.

F. The incident energy calculations must consider the accumulation of energy over time when performing arc flash calculations on buses with multiple sources. Iterative calculations must take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators should be decremented as follows:
   1. Fault contribution from induction motors should not be considered beyond 3 to 5 cycles.
   2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to 3 per unit after 10 cycles).

G. For each equipment location with a separately enclosed main device (where there is adequate separation between the line side terminals of the main protective device and the work location), calculations for incident energy and flash protection boundary shall include both the line and load side of the main breaker.

H. Include Arc Energy Reduction (AER) analysis in the study when required by other specification sections.

I. When performing incident energy calculations on the line side of a main breaker (as required per the above), the line side and load side contributions must be included in the fault calculation.

J. Miscoordination should be checked among all devices within the branch containing the immediate protective device upstream of the calculation location, and the calculation should utilize the fastest device to compute the incident energy for the corresponding location.

K. Arc flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE

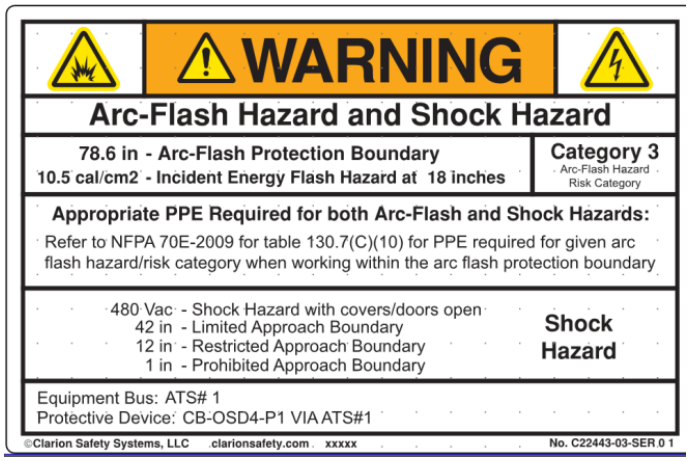
1584-2002 section.

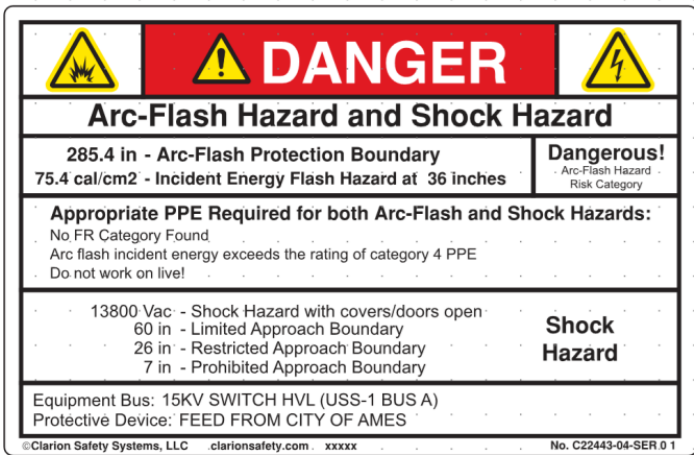
L. Where it is not physically possible to move outside the flash protection boundary in less than 2 seconds during an arc flash event, a maximum clearing time based on the specific location shall be utilized.

M. Create and install NFPA 70E compliant labels describing the arc flash hazard level at all switchboards, panelboards, and other locations in the electrical distribution system where work could be performed on energized parts.

N. The label shall include the incident energy calculated in the analysis and the hazard category or appropriate personal protective equipment (PPE) required to perform maintenance on the system when energized. Labels shall be vinyl or laminated, with a self-adhesive backing.

O. Examples showing the minimum required information follow:





P. A list of all hazard categories and the corresponding PPE requirements shall be posted in the main electric room, engineering office, or other location. The list shall be plastic laminate or typewritten and housed in a plastic frame.

3.4 ADJUSTMENTS

A. Manufacturer authorized representative or Contractor shall set all adjustable protective devices to values indicated in the approved coordination study.

B. Wherever the arc flash incident energy exceeds Arc Flash Category 2 (i.e. > 8 cal/cm^2), provide options for adjusting breaker trip times, if possible, to reduce energies to Category 2 or below.

3.5 TRAINING

A. Provide four hours of Owner training to explain the implications of arc-flash requirements and work permit procedure.

END OF SECTION

SECTION 26 09 33 - LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Line and low voltage standalone lighting controls

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
   1. 26 51 19 LED Lighting
   2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details

1.3 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.
B. All components/assemblies are to be factory pre-tested prior to delivery & installation.
C. Comply with NEC as applicable to electrical wiring work.
D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.
F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.4 REFERENCES

A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference
B. FS W S 896 Switch, Toggle
C. International Energy Conservation Code (IECC)
D. NEMA WD 1 - General Color Requirements for Wiring Devices
E. NEMA WD 7 - Occupancy Motion Sensors
F. NFPA 70 - National Electrical Code (NEC)
G. UL Standard 916 Energy Management Equipment
H. UL 924 - Emergency Lighting and Power Equipment
I. UL 1472 – Solid-State Dimming Controls

1.5 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements.

C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.

D. Submit a list of devices and equipment to be installed for each sequence of operation.

E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations.

1.6 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

1.8 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.

1. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.

B. The following control types and features are acceptable. Acceptable control

locations are shown on the drawings.

1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
2. Distributed Control: Control equipment is in the space being controlled; not reliant on centralized controllers.

1.9 COMMISSIONING

A. Commissioning of a system or systems specified in this section is part of the construction process. Documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel, is required in cooperation with the Owner's Representative. Project closeout is dependent on successful completion of all commissioning procedures, documentation, and issue closure. Refer to Division 1 for detailed commissioning requirements.

1.10 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROLS

A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications.

B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.

C. Functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish functions described for the space.

D. Approved manufacturers: Sensor switch, Wattstopper.

2.2 LIGHTING CONTROL STATION

A. The lighting control station shall contain the controls required by the lighting sequence of operation in a common coverplate. The controls may consist of switches, dimmers, occupancy sensors, pushbuttons, etc.

1. In spaces where wall control station is shown in multiple locations, sequence of operation shall be the same at all locations, unless noted otherwise.
2. The controls supplier shall prepare control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. The shop drawing submittal should be identified with the lighting sequence that the station provides. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

2.3 DEVICE COLOR

A. All switch, lighting controls, and coverplate colors shall be the same as wiring

devices, unless indicated otherwise.

2.4 COVERPLATES

A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space.
B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
C. Install nameplate identification as indicated in Section 26 05 53.
D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.5 WALL SWITCHES

A. Refer to Electrical Symbols List for device type.
B. Single Pole Switch:
    1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
C. Two Pole Switch:
    1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
D. Three-way Switch:
    1. 120/277 volt, 20 amp. Toggle handle, side and back wired.
E. Four-way Switch:
    1. 120/277 volt, 20 amp. Toggle handle, side and back wired.

2.6 LOCAL DAYLIGHTING CONTROLS

A. Standalone Interior Photo Sensors:
    1. Daylight Level Sensor and Controller - 0-10V Dimming - One Zone:
        a. Dimming control of one 0-10V zone. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinated with dimming ballast prior to submittal.
    2. Daylight Level Sensor and Controller - Dimming - Three Zones:
        a. Dimming control of up to three zones of 0-10V. Range of 10 to 200 FC. Adjustable deadband prevents cycling. Adjustable time delay. Coordinate with dimming ballasts prior to submittal.
    3. Sensor shall detect changes in ambient light level and provide triggering of lighting groups in area based on sequence of operation.
    4. Sensor shall provide on/off setpoints in quantity as specified on drawings and as shown in the sequence of operation.
    5. Sensor shall be ceiling- or wall-mounted for range and viewing angle meeting application requirements as outlined in the sequence of operation.
    6. Output signal from sensor shall be linear with light level.

2.7 INDOOR OCCUPANCY & VACANCY SENSORS (DUAL TECHNOLOGY ONLY)

A. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.
    1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied, with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes. Vacancy sensors require a manual switch operation to turn lights on and off, with a time

delay for turning lights off when unoccupied.

2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.
    c. Time Delay and Sensitivity Adjustments: Recessed and concealed.
5. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
8. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
9. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.
10. Warranty: Five (5) year warranty.

B. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.
1. 360 Degree Coverage Pattern:
    a. Frequency greater than 40 KHz. Dual sensing verifications (requires both technologies to activate), either technology maintains on status. Integrated ambient light level sensor (2 to 200 FC range), adjustable sensitivity and time delay. Sensor shall control all circuits in area, unless noted otherwise. Initial settings: ambient sensor 40 FC.
2. Wall Mounted on Adjustable Swivel Mount:
    a. Wall or ceiling sensor with adjustable settings to allow manual on/auto off or auto on/auto off. Integrated ambient light level sensor (2 to 100 FC
3. Wall Switch:
    a. Wall switch with manual on/auto off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of minor motion in 12' x 15' pattern.
4. Wall Switch:
    a. Multi-relay wall switch with manual on/auto off for two separate loads. 120/277 VAC load relay rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 30-minute adjustable OFF delay. Coverage of

minor motion in 12′ x 15′ pattern.

5. Sensitivity Adjustment: Separate for each sensing technology.
6. Detection Coverage:
    a. Task Areas: Detect occupancy anywhere in an area based on hand motion.
    b. Circulation Areas: Detect occupancy anywhere in an area based upon half-step walking motion.

C. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

D. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.
1. Wall Switch Occupancy Sensor:
    a. Passive infrared, zero crossing circuitry, adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
2. Dual Wall Switch Occupancy Sensor:
    a. Passive infrared, zero crossing circuitry. Switches control two separate circuits or relays. adjustable sensitivity and time delay, no minimum load requirements, manual or auto on operation, Initial settings: 10 minutes, ambient sensor 40 FC. Manual ON for vacancy sensing.
3. Ceiling Mounted - 360 Degree Coverage Pattern:
    a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: ambient sensor 40 FC.
    b. Approved Manufacturers: Watt Stopper CI Series, Sensor Switch CM-9, Hubbell Automation Omni-IR, Leviton OSC Series, Greengate OMR-P Series.
4. Ceiling Mounted - 100 Degree Coverage Pattern:
    a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC Range), adjustable sensitivity and time delay. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: ambient sensor 40 FC.
5. Wall Mounted - 100 Degree Coverage Pattern:
    a. Passive infrared, zero crossing circuitry, integrated ambient light sensor (4 to 190 FC range), adjustable sensitivity and time delay. Sensor shall control all circuits in the area unless noted otherwise. Initial settings: Ambient sensor 40 FC.
6. With daylight filter and lens to afford coverage applicable to space to be controlled.

E. Ultrasonic Type: Ceiling mounting. Detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.
1. 360 Degree 20′ x 20′ Hand Motion Coverage Pattern:
    a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated 1-amp relay contact, temperature

and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.

2. 360 Degree Two-Sided Corridor Coverage Pattern:
   a. Frequency greater than 32 KHz solid state, adjustable sensitivity and time delay, integral isolated relay contact, temperature and humidity resistant receivers. Sensor shall control all circuits in area, unless noted otherwise.
3. Wall Mounted:
   a. Wall switch with adjustable settings to allow manual on/auto off or auto on/auto off.
4. Crystal controlled with circuitry that causes no detection interference between adjacent sensors.
5. Lighting control coordination: Provide ALCR device compatible with designated.

2.8 CONDUCTORS AND CABLES

A. Control Wiring:
   1. Where installed with the line-voltage wiring, control wiring shall be copper conductors not smaller than No. 16 AWG with insulation voltage rating and temperature rating equal to that of the line-voltage wiring, complying with Division 26 Section 26 05 13 "Wire and Cable."
   2. Tap conductors to switches or relays: Stranded copper conductors of 16 AWG or solid 16 or 18 AWG with insulation rating equal to that of the line-voltage wiring.
   3. Tap conductors to dimming ballasts: Solid copper conductors of 18 AWG with insulation voltage rating equal to that of the line-voltage wiring and insulation temperature rating not less than 90°C.
   4. Network cabling as required by manufacturer.

B. Splices and Taps:
   1. Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive work.
B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.
C. Verify required utilities are available, in proper location, and ready for use.
D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.
B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.

C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.3 SUPPORT SERVICES

A. Testing:
   1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
   2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:
      a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
      b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
      c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner operating requirements.
   3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
   4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.
      a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
      b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

B. Training:
   1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.

C. Documentation:
   1. Manufacturer shall provide system documentation including:
      a. System one-line showing all panels, number and type of control stations and sensors, communication line, & network or BMS/BAS interface unit.
      b. Drawings for each panel showing hardware configuration & numbering.
      c. Panel wiring schedules.
      d. Typical diagrams for each component.

END OF SECTION

SECTION 26 20 00 - SERVICE ENTRANCE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Arrangement with Utility Company for permanent electric service.
B. **Underground** service entrance

1.2 RELATED SECTIONS AND WORK

A. Refer to the One-Line Diagram for additional information.

1.3 QUALITY ASSURANCE

A. Utility Company: <Insert>.
B. Contact: <Insert>.
C. Install service entrance in accordance with Utility Company's rules and regulations.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00.

1.5 SYSTEM DESCRIPTION

A. System Voltage: **208Y/120** volts, three phase, **three-four-**]wire, 60 Hertz.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

A. Meter: Furnished by the Utility Company.
B. Meter Base: Furnished by the Contractor, as approved by the Utility Company. (Manufacturers: Milbank, Superior, Duncan, or Anchor).
C. Exterior Mounted Metering Cabinets: Furnished and installed by the Contractor to Utility Company's specifications. Conduit and conductors between metering cabinets and instrumentation shall be by the Contractor. Connections as required by the Utility Company.
D. M-<insert#>; Meter Distribution Center:
    1. Manufacturers:
        a. Square D EZ Meter-Pak
        b. General Electric
        c. Siemens

PART 3 - EXECUTION

3.1 INSTALLATION

A. Make arrangements with Utility Company to obtain permanent electric service to Project.
B. Primary distribution equipment and pad-mounted transformers shall be furnished and installed by the Utility Company.
C. Primary conductors shall be furnished, installed, and terminated by the Utility Company. Primary conduit shall be furnished and installed by the Contractor, as shown on the drawings, to the Utility Company's requirements.

D. Underground: Install service entrance conduits in concrete envelope from Utility Company pad mounted transformer to meter cabinet and building service entrance equipment. Utility Company will connect service conductors to transformer secondary lugs.
E. Concrete Pad for Transformer: Furnished and installed by the Contractor to Utility Company's specifications.

END OF SECTION

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Main and distribution switchboards**: MSB**

1.2 RELATED SECTIONS AND WORK

A. Refer to the One-Line Diagram for size, rating, and configuration.

1.3 REFERENCES

A. ANSI C12 - Code for Electricity Metering
B. ANSI C39.1 - Requirements for Electrical Analog Indicating Instruments
C. ANSI C57.13 - Requirements for Instrument Transformers
D. NEMA AB 1 - Molded Case Circuit Breakers
E. NEMA KS 1 - Enclosed Switches
F. NEMA PB 2 - Dead Front Distribution Switchboards
G. NEMA PB 2.1 - Instructions for Safe Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or less

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Include front and side views of enclosures with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
C. Submit manufacturer's instructions under provisions of Section 26 05 00.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under provisions of Section 26 05 00.
B. Deliver in 48-inch maximum width shipping splits, unless approved otherwise by both the Contractor and Architect/Engineer, individually wrapped for protection, and mounted on shipping skids.
C. Store and protect products under provisions of Section 26 05 00.
D. 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.
E. Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00.
B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

2.1 GENERAL

A. Approved Manufacturers:
   1. Square D
   2. General Electric
   3. Siemens
   4. Cutler Hammer

2.2 RATINGS

A. Definitions:
   1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. Refer to Section 26 05 53 for additional requirements.
   2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The switchboards for this project Main Breaker shall be fully rated.

2.3 SWITCHBOARD CONSTRUCTION AND RATINGS

A. Factory-assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load-side terminations.
B. Switchboard electrical ratings and configurations as shown on the drawings.
C. Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.
D. Main Section Devices: Individually mounted and compartmented.
E. Distribution Section Devices: Individually mounted.
F. Auxiliary Section Devices: Individually mounted and compartmented.
G. Bus Material: Aluminum with tin plating, sized in accordance with NEMA PB 2.
H. Bus Connections: Bolted, accessible from front only for maintenance. Plug-on connections may be utilized with Architect/Engineer's pre-approval by addenda.
I. Bus bars shall be fully isolated, braced for minimum ampere rms symmetrical rating as indicated on drawings.
J. The bus shall extend the full height of the distribution sections to provide space for future breakers.
K. Provide a 1 X 1/4-inch copper ground bus through the length of the switchboard.
L. Enclosure shall be NEMA PB 2; Type 1 - General-Purpose. Sections shall align at front and rear.
M. Switchboard Height: NEMA PB 2; 92 inches, excluding floor sills, lifting members and pull boxes.
N. Finish: Manufacturer standard light gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion-resisting paint, or plate with cadmium or zinc.
O. Pull Box: Same construction as switchboard, size as shown on the drawings. Top

and sides shall be removable. Insulating, fire-resistive bottom with separate openings for each circuit

P. Future Provisions: In addition to the spare devices shown, provide equipped space for future devices with bussing and bus connections, suitably insulated and braced for short circuit currents. Continuous current rating as indicated on the drawings.

Q. Suitable for use as service entrance equipment.

2.4 SWITCHING, OVER-CURRENT PROTECTIVE DEVICES, & ARC ENERGY REDUCTION

A. Fusible Switch Assemblies: Quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class 'R' fuses, type as specified, with Class 'R' rejection clips.

B. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide breaker interrupting ratings per coordination study.

C. Solid State Molded Case Circuit Breakers: Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with a sealable clear cover.

D. Arc Energy Reduction:

1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,000 amps or larger.

2.5 INSTRUMENTS AND SENSORS

A. Current Transformers: Current transformers shall be provided by utility and installed by utility.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install switchboard in locations shown on the drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.

C. Install fuses in each switch.

3.2 FIELD QUALITY CONTROL

A. Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

B. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

C. Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

D. Physically test key interlock systems to ensure proper function.

3.3 ADJUSTING AND CLEANING

A. Adjust all operating mechanisms for free mechanical movement.

B. Touch up scratched or marred surfaces to match original finish.

C. Provide time/current trip curves for all adjustable protection devices that require setting. Also provide curves and equipment information for associated new and existing fixed devices that require coordination with new protection devices. Submit time/current curves in hard copy or electronic format.

D. Adjust trip and time delay settings to values as scheduled, or as instructed by the Architect/Engineer.

E. Where two levels of ground fault are provided, test ground fault circuit breakers to prove selective coordination in accordance with manufacturer's directions. Provide testing documentation with Operating & Maintenance Manual submittals.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting and appliance branch circuit panelboards**:**

1.2 RELATED SECTIONS AND WORK

A. Refer to the One-Line Diagram & Panel Schedules for size, rating, & configuration.

1.3 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers
B. NEMA KS 1 - Enclosed Switches
C. NEMA PB 1 - Panelboards
D. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less
E. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment
F. UL 248 – Low-Voltage Fuses
G. UL 67 - Panelboards

1.4 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.
B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
C. Selective coordination study to prove that all essential electrical systems, emergency systems and legally required standby system panelboards are selectively coordinated with all supply side overcurrent protective devices.

1.5 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

PART 2 - PRODUCTS

2.1 RATINGS

A. Definitions:
    1. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.
B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 BRANCH CIRCUIT PANELBOARDS

A. General
    1. Approved Manufacturers:
        a. Square D
        b. General Electric

c. Siemens
d. Cutler Hammer

B. Lighting & Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.
C. Enclosure: NEMA PB 1; Type 1.
D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. hinged trim to allow access to wiring gutters without removal of trim and flush lock all keyed alike. Hinged trim shall be secured with screws. Finish in manufacturer's standard gray enamel.
E. Provide panelboards with aluminum bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.
F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.
G. Minimum Integrated Short Circuit Rating: As shown on the drawings.
H. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb as indicated on drawings in conformance with NEMA PB 1.1.
B. Height: 6 feet to handle of highest device.
C. Provide filler plates for unused spaces in panelboards.
D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 24 19 - MOTOR CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual motor starters
B. Magnetic motor starters
C. Combination magnetic motor starters

1.2 RELATED SECTIONS AND WORK

A. Refer to Disconnect & Starter Schedule & One-Line Diagram for rating & configuration.

1.3 REFERENCES

A. ANSI/UL Standard 508. Standard for Industrial Control Equipment
B. FCC Rules and Regulations, Part 15, Subpart J- Radio Frequency Interference
C. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service
D. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)
E. FS W-P-115 - Power Distribution Panel
F. FS W-S-865 - Switch, Box, (Enclosed), Surface-Mounted
G. IEEE Standard 519-1981 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters
H. NEMA AB 1 - Molded Case Circuit Breakers
I. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies
J. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
K. NEMA KS 1 - Enclosed Switches
L. NEMA PB 1 - Panelboards
M. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or less

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00.
B. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; wiring diagrams that differentiate between manufacturer-installed and field-installed wiring; nameplate legends; size and number of bus bars per phase, neutral, and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.
C. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and over-current protective devices.
D. Submit manufacturer's instructions under provisions of Section 26 05 00.

1.5 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.
B. Fuses: Furnish three (3) spare fuses of each type and rating installed to Owner.
C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Deliver in 60-inch maximum width shipping splits, individually wrapped for protection, and mounted on shipping skids.
C. Store and protect products under provisions of Section 26 05 00.
D. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from fumes, dirt, water, construction debris, traffic, and physical damage.
E. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00.
B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

PART 2 - PRODUCTS

2.1 MANUAL MOTOR STARTERS

A. Acceptable Manufacturers:
   1. Square D
   2. Eaton
   3. ABB
   4. Siemens
B. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for induction motors rated in horsepower, with overload relay, and toggle operator.
C. Fractional Horsepower Manual Starter: NEMA ICS 2; AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit, and toggle operator.
D. Motor Starting Switch: NEMA ICS 2; AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, and toggle operator.
E. Enclosure: NEMA ICS 6; Type 1.

2.2 MAGNETIC MOTOR STARTERS

A. Acceptable Manufacturers:
   1. Square D
   2. Eaton
   3. ABB
   4. Siemens
   5. Franklin Control
B. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower.
C. Full Voltage Starting: Non-reversing type, unless otherwise indicated.
D. Coil Operating Voltage: 120 volts, 60 Hertz, obtained from integral control power transformer of sufficient capacity to operate connected pilot, indicating, and control devices, plus 100% spare capacity.

E. Size: NEMA ICS 2; size as shown on the drawings.
F. Overload Relay:
   1. Overload Relay: Ambient-compensated type with inverse-time-current characteristic and NEMA ICS 2, Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect and with appropriate adjustment for duty cycle.
G. Enclosure: NEMA ICS 6; Type 1.
H. Combination Motor Starters: Combine motor starters with disconnect switch in common enclosure. Provide with disconnecting means as indicated on drawings.
I. Auxiliary Contacts: NEMA ICS 2; two normally open, field convertible contacts in addition to seal-in contact.
J. Pushbuttons: NEMA ICS 2; START/STOP in front cover.
K. Indicating Lights: NEMA ICS 2; RUN: red in front cover.
L. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor control equipment in accordance with manufacturer's instructions on concrete bases.
B. Motor Starter Panelboard Installation: In conformance with NEMA PB 1.1.
C. Install fuses in fusible switches.
D. Select & install heater elements in motor starters to match installed motor characteristics.
E. Set field-adjustable switches and circuit-breaker trip ranges.
F. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.
G. Coordinate size & location of concrete bases. Cast anchor-bolt inserts into bases.

END OF SECTION

SECTION 262713 MODULAR METER CENTERS

PART 1 GENERAL

1.1 SCOPE

A. Work under this section includes furnishing, installations and connections of the meter centers as shown on the plans and as specified herein.

1.2 RELATED SECTIONS

A. Section 260500 - General Requirements
B. Section 260519 - Low Voltage Electrical Power Conductors and Cables (600 Volts & Below)
C. Section 260526 - Grounding and Bonding for Electrical Systems
D. Section 260533 - Raceway and Boxes for Electrical Systems
E. Section 260553 - Identification for Electrical Systems
F. Section 262813 - Fuses
G. Section 262816 - Enclosed Switches and Circuit Breakers

1.3 SUBMITTALS

A. Shop Drawings
   1. Submit shop drawings and product data in accordance with Division 1.
   2. Submit shop drawings for meter centers (and electric sub-metering equipment for non-utility metering).

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Modular Meter Centers: Eaton, Cutler Hammer, Murray, General Electric, Siemens ITE. Talon, and Square D. or approved by the Utility DTE.
B. Electric sub-metering - Planned Energy Systems, Inc.

2.2 MODULAR METER CENTERS

A. Furnish and install where indicated a dead-front grouped meter center incorporating circuit breakers of the rating and type noted herein or shown on the drawings. Meter centers shall have NEMA 1 general purpose surface mounted enclosure. For outdoor installations provide NEMA 3R rainproof enclosures with hinged circuit breaker covers. All meter centers shall be rated for the intended voltage and shall be in accordance with the Underwriters' Laboratories, Inc. Standard for panelboards UL 67 Guide No. 320 BO File E31679.
B. Meter centers installed as a main service employing a main disconnect ahead of the meter units, must be listed as suitable for use as service equipment.
C. All interiors shall be completely factory assembled with main lugs, neutral wire connectors and bus bars. All wire connectors and terminals shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated. Interiors shall be so designed that branch circuit breakers and metering units can be replaced without disturbing adjacent units and without removing the main bus connectors. Socket jaws must be front removable through meter opening without removing steel cover. Back pan shall be removable.

D. Bus bars for the mains and cross connectors shall be of copper or tin plates aluminum in accordance with Underwriters' Laboratories standards. Busing shall be braced throughout to conform to industry standard practice governing short circuit stresses in meter center. Single bolt connection with Belleville type spring washers are required for all bus bar connections. Tight barrier construction is required to isolate customer load compartment from incoming service connectors. Main lug provision must accept top or bottom feed on all meter center units. All branch circuits for indoor units must be able to exit from top or bottom of unit. Neutral busing shall have a suitable lug for each out-going feeder requiring a neutral connection of same ampacity as branch.
E. Entire modular meter center assembly shall be U.L. listed for a (see drawings) A.I.C. integrated rating to protect (see drawings) A.I.C. rated panels or load centers equipped with (see drawings) A.I.C. circuit breakers for this project application.
F. Boxes shall be made from cold rolled code gauge sheet steel having multiple knockouts. Raintight boxes shall use galvanized steel. Boxes shall be of sufficient size to provide at least a minimum code gutter space on all sides. Individual boxes shall be rigidly constructed. Boxes shall be constructed with mounting provisions for grounding bars to be installed where necessary. Boxes and trim shall be bonderized and finished with medium light gray ASA49 enamel. Front covers shall fit ringless type sockets and allow individual access per meter, i.e., split covers.
G. Main disconnects shall be quick-make, quick-break load-break fusible type with padlocking and sealing provisions. Disconnects shall be bused for direct connection to meter center buses. Provide plug-in adapter from bus duct to main switch where applicable.
H. Meter Sockets:
    1. Residential single-phase type for apartments/condos shall be 5 jaw rated for (see drawings) amp continuous duty.
    2. Commercial three phase type shall be 7 jaw with lever type bypass switch (see drawings) amp continuous duty.
    3. Meter sockets shall be stacked (5) high or in configuration as shown on plans.
I. Circuit Breakers:
    1. 120/208 volt system plug-in type to (see drawings) ampere rating and bolt-on above.
    2. Circuit breakers shall have A.I.C. ratings based on the calculated available Fault Current from the Utility Company DTE.

2.3 ELECTRIC SUB-METERING

A. Provide sub-metering as shown on plans including all meters, current transformers, wiring and connections. Energy Monitoring Systems, Inc. Product numbers are listed for the purpose of identifying quality and function.
B. Complete system package shall include meter, indoor-outdoor enclosure, faceplate and current transformers.
C. Watt hour meters shall be current transformer operated with digital counter equipped with cylometer register manufactured to ANSI Standard C-12.6.1.8
D. Current transformers, one per phase, shall be doughnut type with primary rating as required and 5 ampere secondary. Current transformers shall be manufactured to ANSI Standard C-12, C57-13. Where applicable current transformers may be remote mounted directly in the circuit breaker panelboard enclosure.
E. Provide metering equipment as follows for the system voltage applied.

Voltage System Meter Remote Counter

1. 120/240V-1PH-3W #7124 #9124
2. 120/208V-1PH-3W #7220 #9220
3. 120/208V-3PH-4W #7320 #9320

F. Meter and control wiring shall be 600V insulated #18-gauge copper or as recommended by manufacturer.

PART 3 EXECUTION

3.1 MODULAR METER CENTERS

A. Coordinate & verify power company requirements for exact type of meter socket required.
B. Meters will be furnished and installed by the utility providing service.
C. Furnish and install plug-in circuit breakers.
D. Furnish and install circuit breaker in main disconnect switches.
E. Provide engraved identification label for each tenant circuit breaker nameplate.

3.2 ELECTRIC SUB-METERING

A. Provide complete wiring diagrams with shop drawings for each type of sub-meter installation. Diagrams shall show all wires, wire size and all connection points.
B. Each installation shall be tested and certified in writing to be operational and correct.
C. Provide complete operation and maintenance manuals.
D. Provide (1) hour of instruction to the Owner Representative for operation of the system and meter reading.
E. Exposed meter wiring shall be installed in conduit or metallic raceway.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Device plates and box covers
B. Modular connectors
C. Receptacles

1.2 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the NEC Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
C. Comply with the NEC.

1.3 REFERENCES

A. DSCC W-C-896F – General Specification for Electrical Power Connector
B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet
C. NEMA WD 1 – General Color Requirements for Wiring Devices
D. NEMA WD 6 – Wiring Devices – Dimensional Requirements
E. NFPA 70 - National Electrical Code (NEC)
F. UL 498 – Standard for Attachment Plugs and Receptacles
G. UL 943 – Standard for Ground Fault Circuit Interrupters

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.5 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

A. All switch, receptacle, outlet, and coverplate colors shall be imatch existing unless indicated otherwise.

2.2 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:
   1. Unbreakable thermoplastic/thermoset plastic coverplates in finished spaces where walls are finished.
B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.
C. Install nameplate identification as indicated in Section 26 05 53.
D. Plate securing screws shall be metal with head color matching wall plate finish.

2.3 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. NEMA 5-20R Duplex Receptacle:
   1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.
   2. Approved Manufacturers: Hubbell 5352A, Leviton, 5362-S, Pass & Seymour 5362, Cooper 5352.
   3. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and brass back strap.
   4. Approved Manufacturers: Hubbell 5352, Leviton 5362-S, Pass & Seymour 5362, Cooper 5362.

C. NEMA 5-20R Ground Fault Duplex Receptacle:
   1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face.
   2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
   3. Approved Manufacturers: Hubbell GF20L, Leviton GFNT2, Pass & Seymour 2097, Cooper SGF20.

D. Remote Ground Fault Device:
   1. Ground fault device for remote downstream receptacles. 125-volt, 20 amp. Test and reset buttons in impact resistance thermoplastic face.
   2. Approved Manufacturers: Hubbell GFBF20, Leviton 6895, Pass & Seymour 2085, Cooper VGFD20.

E. NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:
   1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face. Provide NEMA 3R rated while-in-use cast aluminum cover.
   2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
   3. Approved Manufacturers: Hubbell GFTR20/(RW57300) WP826, Leviton GFWT2/(5977-CL) M5979, Pass & Seymour 2097TRWR/(WIUC10-C) WIUCAST1, Cooper WRSGF20/(WIU-1) WIUMV-1.

F. NEMA 5-20R Receptacle with USB Charger:
   1. 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face. Type A USB charging rated at 5VDC 2.1A. Mounted in double gang backbox.
   2. Approved Manufacturers: Hubbell USB20X2, Pass & Seymour TR5362USB, Cooper TR7766.

G. NEMA 5-20R Receptacle with Arc Fault Circuit Interrupts
   1. 125-volt, 20 amp, 3-wire grounding type hospital grade, arc fault circuit interrupter receptacle with test & reset buttons in impact resistant thermoplastic face.
   2. Approved Manufacturers: Leviton AFTR2.

H. NEMA 5-20R Tamper Resistant Duplex Receptacle:
   1. 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.
   2. Approved Manufacturers: Hubbell BR20TR, Leviton TBR20, Pass & Seymour TR5362, Cooper TRBR20.
   3. Provide decorative style duplex tamper resistant receptacles in public spaces where walls are finished.

4. Approved Manufacturers: (Decorative), Hubbell DR20TR, Leviton TDR20, Pass & Seymour TR2635.

I. NEMA 5-20R GFI Tamper Resistant Receptacle:
   1. 125-volt, 20 amp, 3-wire grounding type tamper-resistant with test and reset buttons in impact resistant thermoplastic face.
   2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
   3. Approved Manufacturers: Hubbell GFTR20, Cooper TRSGF20, Pass & Seymour 2097TR, Leviton GFTR2.

J. NEMA 5-20R Double Duplex Receptacle:
   1. Consists of two duplex receptacles, double gang box, plaster ring & faceplate.
   2. Approved Manufacturers: Refer to Duplex Receptacle Above

K. NEMA 5-20R Double Duplex GFI Receptacle:
   1. Consists of two duplex GFI receptacles, double gang box, plaster ring & faceplate.
   2. Approved Manufacturers: Refer to Duplex GFI Receptacle above,

L. NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:
   1. Consists of two duplex, GFCI receptacles. Double gang box. Provide extra-duty NEMA 3R rated while-in-use cast aluminum cover.
   2. Approved Manufacturers: Refer to GFCI Receptacle above.
   3. Cover: Intermatic WP1030MXD, Pass & Seymour WIUCAST2, Thomas & Betts Red Dot 2CKU.

M. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

N. Side wired devices shall have four binding screws that are undercut for positive wire retention.

O. Ground fault circuit interrupter (GFCI) receptacles shall comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines.

C. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

D. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

E. Install devices and wall plates flush and level.

END OF SECTION

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Fuses

1.2 REFERENCES
A. UL 198E - Class R Fuses
B. NFPA 70 – National Electrical Code

1.3 SUBMITTALS
A. Submit product data under provisions of Section 26 05 00.

1.4 EXTRA MATERIALS
A. Provide three of each size and type of fuse installed.

1.5 PROJECT CONDITIONS
A. Where ambient temperature to which fuses are directly exposed is less than 40°F (5°C) or more than 100°F (38°C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – FUSES
A. Bussman, Division of Eaton
B. Edison Fuse, Division of Cooper Industries
C. Mersen
D. Littelfuse Inc

2.2 FUSES
A. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.
B. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.
C. Control transformer fuses: Class CC (time delay).
D. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION
A. Install fuses where required.
B. Install fuses in accordance with manufacturer's instruction.
C. Install fuses in packaged equipment as required by equipment manufacturer.
D. Install fuse with label oriented such that manufacturer, type, & size are easily read.

END OF SECTION

SECTION 26 28 16 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fusible switches
B. Non-fusible switches
C. Enclosures

1.2 REFERENCES

A. NEMA KS 1 - Enclosed Switches

1.3 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Product Data: For each type of enclosed switch, circuit breaker, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.
C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.4 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Acceptable Manufacturers:
   1. Square D
   2. Eaton
   3. ABB
   4. Siemens
B. Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on drawings.
   Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated on the drawings.
B. Install fuses in fusible disconnect switches.
C. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

END OF SECTION

SECTION 26 29 23 - VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Variable frequency drives

1.2 RELATED SECTIONS AND WORK

A. Refer to the Variable Frequency Drive Schedule for rating and configuration.

1.3 REFERENCES

A. ANSI/UL Standard 508
B. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems
C. IEEE Standard 519-1992 - Guide for Harmonic Control and Reactive Compensation of Static Power Converters
D. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00.
B. Shop Drawings: Include front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.
C. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.5 EXTRA MATERIAL

A. Furnish under provisions of Section 26 05 00.
B. Provide two of each air filter.
C. Provide three of each fuse size and type.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of 26 05 00.
B. Accept controllers on site in original packing. Inspect for damage.
C. 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.
D. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00.
B. Maintenance Data: Include spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and

intervals.

C. Operation Data: Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

D. Shop Drawings: For each VFD.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:
   a. Each installed unit's type and details.
   b. Nameplate legends.
   c. Short-circuit current rating of integrated unit.
   d. UL listing for series rating of overcurrent protective devices in combination controllers.
   e. Features, characteristics, ratings, and factory settings of each motor-control center unit.
2. Wiring Diagrams: Power, signal, and control wiring for VFDs. Provide schematic wiring diagram for each type of VFD.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS: ABB, SQUARE D, TOSHIBA

2.2 DESCRIPTION

A. Converts 60 Hertz input power at voltage specified to a variable AC frequency and voltage for controlling the speed of AC squirrel cage motors. The controller shall be suitable for use with standard NEMA B squirrel cage 1.15 service factor induction motors without requiring any modifications to the motor or the drive.

B. Controller shall have sufficient capacity to provide speed control of the motors shown or noted throughout the specified environmental operating conditions.

C. Controller shall have the functional components listed below:

1. Door interlocked input circuit breaker/fused switch.
2. Input rectifier section to supply fixed DC bus voltage.
3. Smoothing reactor for DC bus.
4. DC bus capacitors.
5. Control transformer.
6. Separate terminal blocks for power and control wiring.
7. Terminal block for operator controls.
8. Sine weighted PWM generating inverter section.

2.3 RATINGS

A. Rated Input Voltage: Refer to Variable Frequency Drive Schedule 208V.

B. Motor Nameplate (Drive Output) Voltage: Refer to Variable Frequency Drive Schedule Refer to M & E Schedules.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0°C to 40°C.

E. Minimum Relative Humidity Range: 5% to 90% (non-condensing).

F. Minimum Elevation without Derating: 3300 feet.
G. Minimum Efficiency at Full Load: 96 percent.
H. Overload Capability: 1.1 times the base load current for 60 seconds; 2.0 times the base load current for 3 second.
I. Starting Torque: 100 percent of rated torque or as indicated.
J. Speed Regulation: Plus or minus 1 percent with no motor derating.

2.4 DESIGN

A. Pulse Width Modulated (PWM) Variable Frequency Drives:
   1. Converter shall be of a diode bridge design with a sine-weighted PWM inverter section.
   2. Main semi-conductors in the inverter section of controller shall be IGBT transistors capable of a carrier switching frequency of up to 8 kHz. If derating of the inverter is necessary to run at 8kHz, then the unit's derated currents must equal or exceed the motor full load currents listed in NEC Table 430-150.
   3. All controllers supplied with semi-conductors capable of switching at less than 8,000 Hertz shall be supplied with a motor acoustic noise reduction filter.
   4. Pulse width modulated (PWM) drives shall be supplied with drive input line reactors with a minimum impedance of 3%. Reactors shall be installed to filter entire drive input circuit.
   5. Pulse width modulated (PWM) drives shall be supplied with drive input harmonic filter to reduce the total harmonic distortion to less than the IEEE519-1992 limits at the utility service entrance.
   6. Drives that are located beyond the manufacturer recommended maximum distance from the motor shall be provided with dV/dt (long lead) filters.
B. All drives shall have built-in diagnostic capability with status and fault indicators mounted on enclosure door. Complete operating instructions for diagnostics shall be mounted inside of the enclosure door.
C. Drive shall restart after power loss and under-voltage fault. The minimum number of restart attempts required shall be three, field adjustable.
D. The drive shall allow unlimited switching of the output without damage to the drive or motor.

2.5 PRODUCT FEATURES

A. Display: Provide integral digital display to indicate all protection faults and drive status (including overcurrent, overvoltage, undervoltage, ground fault, overtemperature, phase loss, input power ON, output voltage, output frequency, and output current.
B. Protection:
   1. Input transient protection by means of surge suppressors.
   2. Snubber networks to protect against malfunctions due to system transients.
   3. Under- and overvoltage trips; inverter overtemperature, overload, and overcurrent trips.
   4. Motor thermal overload relay(s) adjustable and capable of NEMA Class 10 motor protection and sized per motor nameplate data. When multiple motors are connected to the VFD output, each motor shall have a manual starter with properly sized overload protection.

5. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
6. Instantaneous line-to-line and line-to-ground overcurrent trips on input and output.
7. Loss-of-phase protection.
8. Reverse-phase protection.
9. Short-circuit protection (fuses or circuit breaker).
10. Motor overtemperature fault.

C. Acceleration Rate Adjustment: 0.5 - 30 seconds.
D. Deceleration Rate Adjustment: 1 - 30 seconds.
E. Minimum Adjustment Range for the Lower Output Frequency shall be: 0 to 40 Hertz.
F. Minimum Adjustment Range for the Upper Output Frequency Range shall be: 40 to 90 Hertz.
G. Minimum Volts/Hertz Range: 3.7 to 8.6 volts/Hertz.
H. Provide MANUAL-OFF-AUTOMATIC selector switch and manual analog speed control mounted on the front of the enclosure.
I. Input and output disconnecting means.
J. Safety Interlocks: Provide terminals for remote contact to inhibit starting under both manual and automatic mode.
K. Control Interlocks: Provide terminals for remote contact to allow starting in automatic mode.
L. Provide adjustable skip frequencies on the drive output (minimum of three ranges).
M. Automatic Reset/Restart: Attempts three restarts after controller fault or on return of power after an interruption, and before shutting down for manual reset or fault correction. Bidirectional autospeed search shall be capable of starting into rotating loads spinning in either direction and returning motor to set speed in proper direction, without damage to controller, motor, or load.
N. Power-Interruption Protection: After a power interruption, it prevents the motor from re-energizing until the motor has stopped.
O. Torque Boost: Automatically varies starting & continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
P. Motor Temperature Compensation at Slow Speeds: Adjustable current fallback based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
Q. Status Lights: Door-mounted LED indicators shall indicate the following conditions:
1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.
R. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
S. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate the following controller parameters:
1. Output frequency (Hz).

2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (VDC).
9. Set-point frequency (Hz).
10. Motor output voltage (V).

T. Control Signal Interface:
1. Electric Input Signal Interface: A minimum of 2 analog inputs (0 to 10 V or 0/4-20 mA) and 6 programmable digital inputs.
2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BMS or other control systems:
   a. 0 to 10-V dc.
   b. 0-20 or 4-20 mA.
   c. Potentiometer using up/down digital inputs.
   d. Fixed frequencies using digital inputs.
   e. RS485.
   f. Keypad display for local hand operation.
3. Output Signal Interface:
   a. A minimum of 1 analog output signal (0/4-20 mA), which can be programmed to any of the following:
      1) Output frequency (Hz).
      2) Output current (load).
      3) DC-link voltage (VDC).
      4) Motor torque (percent).
      5) Motor speed (rpm).
      6) Set-point frequency (Hz).
4. Remote Indication Interface: A minimum of 2 dry circuit relay outputs (120-V ac, 1A) for remote indication of the following:
   a. Motor running.
   b. Set-point speed reached.
   c. Fault and warning indication (overtemperature or overcurrent).
   d. PID high- or low-speed limits reached.

U. Control:
1. With the "Manual-Off-Auto" switch in the "Manual" position and, if applicable, the "Drive-Bypass" in the "Drive" position, the drive shall be controlled by the manual speed potentiometer on the drive door.
2. With the "Manual-Off-Auto" switch in the "Auto" position and, if applicable, the "Drive-Bypass" in the "Drive" position, the drive shall be controlled by the input signal from an external source.
3. With the "Manual-Off-Auto" switch in the "Off" position, if applicable, the drive run circuit shall be open and the VFD shall not operate.
4. All disconnect switches between VFD and motor(s) shall include an auxiliary contact interlock wired to the VFD fault trip input to shut down

the drive upon opening of the disconnect main contacts.

2.6 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. All VFD supplied for fans shall have dynamic or DC injection braking capability to provide a means of rapid deceleration of the AC motor in not more than one (1) minute. Adjust controls to stop the motor within 30 seconds.

C. All high inertia loads that cannot be stopped in 30 seconds with the VFD dynamic braking or DC injection braking shall be provided with a chopper module and dynamic braking resistor to stop the motor within 30 seconds.

D. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.

E. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

F. Control Relays: Auxiliary and adjustable time-delay relays.

G. Standard Displays:
   1. Output frequency (Hz).
   2. Set-point frequency (Hz).
   3. Motor current (amperes).
   4. DC-link voltage (VDC).
   5. Motor torque (percent).
   6. Motor speed (rpm).
   7. Motor output voltage (V).

H. Historical Logging Information and Displays:
   1. Real-time clock with current time and date.
   2. Running log of total power versus time.
   3. Total run time.
   4. Fault log, maintaining last four faults with time and date stamp for each.

I. Fabrication:
   1. Enclosure: NEMA 250, Type 1.
   2. Finish: Manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. VFD manufacturer shall provide certification that heat test has been completed.

B. Electrical Contractor shall have a factory service engineer present for the start-up, field calibration, and check-out of each VFD installed. Factory service engineer shall be required to return to the site for recalibration or set-up should unit not function as specified during system commissioning. All costs shall be a part of This Contract. Provide tag with date and signature of factory service Engineer on inside cover of each drive.

3.2 INSTALLATION

A. Install variable frequency drive equipment in accordance with manufacturer

instructions.

B. Floor mount VFD on prefabricated or field fabricated supports with controls no higher than 6'-6" and no lower than 3'-0" AFF. Mount supports on 1/2" thick vibration isolation pads set on concrete housekeeping pads.

C. Provide engraved phenolic nameplates under the provisions of Section 26 05 53.

D. Connections: All conduit connections to the VFD shall be by flexible conduit.

E. Input, output, and control wiring shall each be run in separate conduits.

F. All interlocking required by the drive manufacturer shall be the responsibility of the Electrical Contractor.

3.3 STARTUP AND COMMISSIONING

A. Verify all settings, parameters, and adjustments with other contractors prior to startup. Make all adjustments and setting to coordinate with controls and equipment.

B. Accelerate the motor to full speed and verify operation. Decelerate the motor to a stop and verify operation. Slowly operate the motor over the speed range and check for resonance.

C. Make all adjustments and settings to coordinate with controls and equipment prior to Substantial Completion. Verify that drive is set for auto restart after power loss and undervoltage fault.

D. Document settings in the Operations and Maintenance manual.

END OF SECTION

SECTION 26 32 13 - PACKAGED ENGINE GENERATOR SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged engine generator system
B. Exhaust silencer and fittings
C. Fuel fittings and day tank
D. Fuel polishing system
E. Remote annunciator panel
F. Battery and charger
G. Weatherproof enclosure

1.2 REFERENCES

A. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
B. ANSI/NEMA AB 1 - Molded Case Circuit Breakers
C. ANSI/NEMA MG 1 - Motors and Generators
D. NFPA 37 - Installation and Use of Stationary Combustion Engines and Gas Turbines
E. NFPA 70 - National Electrical Code (NEC)
F. NFPA 110 - Standard for Emergency and Standby Power Systems
G. IEEE 446 - Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
H. Environmental Protection Agency EPA Emission Standards for Compressed Ignition Engines
I. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at property boundaries due to sound emitted by the generator set, its components and the operation thereof.

1.3 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00.
B. Submit shop drawings showing plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, and electrical diagrams including schematic and interconnection diagrams.
C. Submit product data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, remote radiator, and remote annunciator.
    1. Include work clearance and equipment access information. Clearly identify required equipment access locations for installation, maintenance, testing, and repair.
D. Submit certificates for compliance with EPA Emissions Standards for Compressed Ignition Engines.
E. Submit manufacturer's installation instructions under provisions of Section 26 05 00.
F. Submit complete control and operation sequences for on-board paralleling system.

1.4 EXTRA MATERIALS

A. Submit maintenance materials under provisions of Section 26 05 00.
B. Furnish one set of tools required for preventative maintenance of the engine generator

system. Package tools in adequately sized metal toolbox.

C. Provide two additional sets of each fuel, oil, and air filter element required for the engine generator system. Provide additional fuel polishing filters for one year of operation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Store and protect products under provisions of Section 26 05 00.

C. Accept packaged engine generator set and accessories on site in crates and verify damage.

D. Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.6 SYSTEM DESCRIPTION

A. Engine generator system to provide source of emergency and standby power.

B. System Capacity: 200 KW, 250 KVA, at specified voltage dip, at an elevation of 1,000 feet above sea level, and ambient temperature between -20°F and 110°F; standby rating using engine-mounted radiator.

C. Emergency Power Supply System (EPSS) shall be NFPA 110 Type 10 Class **2** Level **1**.

D. Operation: In accordance with ANSI/NFPA 110.

1.7 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 26 05 00 for required generator electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings. Show generator, fuel system components, battery system components, and exhaust system in 1/4" scale plan of room.

1.8 PROJECT RECORD DOCUMENTS

A. Submit record documents under provisions of Section 26 05 00.

B. Accurately record location of engine generator and mechanical and electrical connections.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data under provisions of Section 26 05 00.

B. Include instructions for normal operation, routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in packaged engine generator system with minimum five (5) years documented experience.

B. Manufacturer: Company with minimum five (5) years of documented on-board paralleling system experience.

C. Supplier: Authorized distributor of engine generator manufacturer with service facilities within 50 miles of the project site.

1.11 WARRANTY

A. Provide a two (2) year warranty under provisions of Section 26 05 00.

1.12 MAINTENANCE SERVICE

A. Furnish service and maintenance of packaged engine generator system for one (1) year from Date of Substantial Completion. Maintenance service shall be performed by

skilled employees of manufacturer's designated service organization. Include quarterly exercising, and routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Maintenance agreements shall include parts, supplies, and labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Caterpillar.
B. Cummins Power Generation.
C. Kohler.

2.2 PACKAGED ENGINE-GENERATOR SET (GEN-#)

A. Packaged engine-generator set shall be a coordinated assembly of compatible components. Stationary generators shall be listed.
B. Safety Standard: Comply with ASME B15.1 and UL 2200.
C. Nameplates: Each major system component shall be equipped with a nameplate to identify manufacturer's name and address, model and serial number, and component rating in integrated set and as required by the contract documents.
D. Fabricate engine-generator set mounting frame and attachment of components to resist generator-set movement during a seismic event when generator-set mounting frame is anchored to building structure.
E. Mounting Frame: Adequate strength and rigidity to maintain alignment of mounted components without depending on concrete foundation. Mounting frame shall be free from sharp edges and corners and shall have lifting attachments arranged for lifting with slings without damaging components. Provide a rigging diagram permanently attached to the mounting frame to indicate the capacity of each lifting attachment and the generator-set center of gravity.

2.3 ENGINE

A. Type: Water-cooled in-line or V-type, compression ignition internal combustion engine.
B. Rating: Sufficient to operate at 100 percent load for two hours at specified elevation and ambient limits.
C. Fuel: Appropriate for use of No. 2 fuel oil.
D. Engine Speed: 1800 RPM.
E. Governor: Isochronous type with speed sensing.
F. Frequency Response:
    1. Steady State Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
    2. Transient Response: Less than 5 percent for a 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady state operating band within 5 seconds.
G. Fuel System: Engine mounted diesel fuel pump and relief-bypass valve.
H. Fuel Supply System:
    1. Base-Mounted Fuel Tank: UL 142 UL 2085 listed fuel tank with 4 hour rated (NFPA 110 minimum run time by class) capacity. Integral rupture basin with leak

detection. Provide fueling port with an overfill prevention type receptacle and lockable cap for exterior units. The tank shall include structural steel supports for top mounted engine generator set. Furnish complete with flexible fuel line connectors[remote][lockable] cover, and analog level gauge. Furnish complete with float switches to indicate 5% 25% 50% and 75% fuel level. The footprint of the base-mounted fuel tank shall not exceed the footprint of the generator frame for interior applications or the footprint of the enclosure for exterior installations.

2. Fuel Cooler: Provide unit-mounted fuel cooler with all required hoses, fittings and mounting hardware.

I. Fuel Polishing System:

1. Fuel polishing system capable of removing 99% of emulsified water and particulate down to 3 microns from the fuel. The system shall be sized so the stored fuel capacity shall be polished at least once per week. The system shall include a pump to circulate the fuel from the storage tank through the filter/separator and return it to the tank, A gauge or alarm shall provide notification when a filter is due for change. A timer shall be set to run the pump during off peak hours.

J. Lubrication System: Engine or skid mounted filter and strainer, thermostatic control valve capable of full flow and designed to be fail safe, and crankcase drain arranged for gravity drainage with siphon or pump.

K. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90°F, and suitable for operation on 120 208-1Ø volts AC. The minimum wattage of the heater shall be watts or as recommended by the manufacturer.

L. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator set mounting frame and integral engine-driven coolant pump.

1. Fan and Core: Nonferrous-metal construction sized to contain expansion of total system. Blower type fan, sized to maintain safe engine temperature in ambient temperature of 110°F. Radiator Airflow Restriction: 0.5 inches of water, maximum.
2. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anti-corrosive additives.
3. Provide expansion tank with gage glass and petcock, and self-contained, thermostatic-control temperature control valve.

M. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel. Provide the following accessories:

1. Battery: Voltage to match starter with capacity for three cranking cycles without recharge. Provide with battery cables and acid resistant battery tray.
2. Battery-Charging Alternator: Factory mounted on engine with solid state voltage regulation.
3. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
4. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted

enclosure to meet ANSI/NEMA 250, Type 1 requirements.

N. Exhaust System: Critical type silencer (85 dBA max at 10 feet), side inlet with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer instructions. Silencer shall include a threaded opening for connection of ¾" drain line. Opening shall be flush on inside of silencer.

O. The packaged engine generator shall comply with the current Environmental Protection Agency EPA Emissions standards.

P. Engine Accessories: Fuel filter, lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gauge, water temperature gauge, and lube oil pressure gauge on engine-generator control panel.

Q. Mounting: Provide unit with suitable spring-type vibration isolators.

2.4 GENERATOR

A. Generator: ANSI/NEMA MG 1; three phase, re-connectible brushless synchronous generator with brushless exciter and PMG alternator excitation.

B. Rating: As indicated on the drawings, at 0.8 power factor, 60 Hertz at RPM to match engine rating.

C. Insulation: ANSI/NEMA MG 1, Class F.

D. Temperature Rise: 105°C continuous.

E. Enclosure: ANSI/NEMA MG 1; open drip-proof.

F. Voltage Regulation:

1. The maximum instantaneous voltage dip (IVD) shall be 28 percent for building loads and 15 percent for the fire pump.
2. Include solid-state type voltage regulator, separate from exciter to match engine and generator characteristics, with voltage regulation ±1 percent from no load to full load. Include manual controls to adjust voltage drop ±5 percent voltage level, and voltage gain.

2.5 CONTROLS AND INDICATION

A. Operating and safety indications, protective devices, basic system controls, and engine gauges shall be grouped in a common control and monitoring panel mounted on the generator set. Mounting method shall isolate the control panel from generator-set vibration.

B. Engine-Generator Control Panel: ANSI/NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:

1. Alarm indication as required by NFPA 110 for a Level[1][2] system.
2. AC frequency meter.
3. AC output voltmeter with phase selector switch.
4. AC output ammeter with phase selector switch.
5. Output voltage adjustment.
6. DC voltmeter (alternator battery charging).
7. Engine start/stop selector switch.
8. Engine running time meter.
9. Oil pressure gauge.
10. Engine coolant temperature gauge.

11. Shut down devices for overspeed, coolant high-temperature, coolant low-level, and oil low-pressure.
12. Fuel derangement alarm.
13. Generator overload.
14. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
15. Remote Alarm Contacts: Pre-wire SPST contacts to terminal strip for remote alarm functions required by ANSI/NFPA 99.
16. Generator control and start signal failure.

C. Remote Engine Annunciator Panel: NFPA 110 for a Level 1 system. Include the listed pre-alarm and alarm points, audible alarm, alarm silencing means, repetitive alarm circuitry, and lamp test switch in a surface mounted panel with brushed stainless steel finish. Provide all interconnecting wiring in conduit per manufacturer's requirements by the Electrical Contractor. Remotely reported alarms shall include the following. Locate as directed by owner.

1. Overcrank
2. Low water (engine) temperature
3. High engine temperature pre-alarm
4. High engine temperature
5. Low lube oil pressure pre-alarm
6. Low lube oil pressure
7. Overspeed
8. Low fuel main tank
9. Low coolant level
10. Not in auto
11. Emergency Power Supply (EPS) supplying load
12. High battery voltage
13. Low battery voltage
14. Battery charger failure (includes AC failure)
15. Generator running
16. Normal utility power
17. Emergency stop
18. Rupture basin alarm
19. Emergency Power Off Switch activated (EPO)
20. Generator control and start signal failure.

D. Remote Engine Manual Start Control: Two-wire remote start control from fire command center. Provide all interconnecting wiring in conduit per manufacturer's requirements (by the Electrical Contractor).

2.6 ACCESSORIES

A. Generator Circuit Breaker: Molded or insulated case, service-rated electronic trip type; 100% rated breaker complying with NEMA AB1 and UL 489. The disconnect shall simultaneously open all associated ungrounded conductors and be lockable in the open position.

1. Tripping Characteristic: Designed specifically for generator protection.
2. Trip Rating: Matched to generator rating.
3. Mounting: Provide freestanding enclosure or mount integrally with control and

monitoring panel.

4. The disconnecting means shall also shut down the prime mover, disable all start control circuits, and be configured with a mechanical reset.

B. EPO; Remote Manual Stop Station (Emergency Power Off EPO): Provide a remote manual stop station with weather proof stainless steel or die cast housing, red mushroom button - push to stop operation, breakable cover/lens to access mushroom button, 120-volt rated. The manufacturer shall provide automatic monitoring of the EPO switch. Placing the EPO switch in the "Generator Powered OFF" status shall initiate a visual and audible alarm at each generator annunciator panel.

1. Remote Manual Stop Station may be located within the generator enclosure when allowed by code. Provide an engraved plastic nameplate "EMERGENCY DISCONNECT - define location", red background, white letters, minimum 4" letters. Provide one nameplate on each side of the generator enclosure with accessible doors.

C. Remote Fuel Fill Station (RFFS-#): Provide a remote fuel fill station including a fill port within a surface-mounted, lockable, NEMA 3R stainless steel construction with gasketed hinged door and lockable handle. The fill port shall have a minimum overflow holding capacity of five (5) gallons. The fill port inside the cabinet shall be field coordinated. Provide dust cover for fill connection. Include local light and horn alarm with test switch and silence feature when tank level is above 95 percent full. Provide additional float switch in tank for level indication. Include the following accessories:

1. Solenoid valve to prevent additional fuel delivery to the tank when full; 120-volt power provided by Contractor.
2. Lockable drain valve for overflow.

D. Crankcase Ventilation System:

1. Provide crankcase ventilation system with the packaged generator. The default crankcase ventilation system shall be an ingestive crankcase system to reintroduce the partially combusted particulate into the engine.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE SKIN-TIGHT

A. Prefabricated or pre-engineered skintight enclosure with the following features:

1. Construction: Reinforced galvanized steel, metal clad, integral structural steel framed housing anchored to a concrete foundation. Construction shall allow access to control panels and service points. The panels shall enclose all components, including intake/exhaust louvers and sound attenuators. Extend the enclosure base frame as required for panels.
2. The generator control panel shall be located no greater than 5'-0" above finished grade for ease of access.
3. Structural Design and Anchorage: Wind resistant up to 100 mph.
4. Louvers: Equipped with bird screen and filter arranged to permit air circulation when engine is not running while excluding exterior dust, birds, and rodents. Motor operators shall be spring open, power close operating at 24 volts DC. The louvers shall be connected to the generator starting batteries through appropriate control relays.[Louvers shall not extend outside main generator enclosure.]
5. Hinged Doors: Provide a minimum of four doors with padlocking provisions. Single doors shall be 36" wide and 84" high. Double doors shall be 60" wide and 84" high. As standard, doors shall include rain-rail moldings above all door

openings, recessed, keyed mortise locks, panic bar door hardware and full weather-stripping. Doors shall be removable.

6. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits as required by engine-generator-set components.
7. Fuel Tank Vent: Provide vent piping from fuel tank to the exterior of enclosure.
8. Fuel Fill: Provide fill access on the exterior of the enclosure at an elevation not to exceed 5'-0" above finished grade.
9. The exhaust system silencer shall be installed within the enclosure housing.
10. Acoustical Treatment: Provide acoustical treatment of the generator enclosure including wall panels, intake and exhaust air paths, ventilation openings, and tailpipe exhaust. Maximum sound level horizontally from the generator set shall be at dBA required by all state and local requirements. Sound attenuators shall be concealed within the enclosure panels. Panels shall extend from the enclosure base frame to the height of the generator section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive work and field dimensions are as shown on drawings.
B. Verify that required utilities are available in proper location and ready for use.
C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install remote manual stop station in generator enclosure and one in main electrical room. Label "Emergency Generator Stop". Provide 120 Volt power and wiring in conduit as required. Coordinate installation with the manufacturer approved shop drawings and wiring diagrams. The remote manual stop station shall shunt trip the generator mounted circuit breaker.
C. The A-B-C phase rotation of the generator source shall match the A-B-C phase rotation of the utility source. The Contractor shall verify the generator and utility phase rotation match to prevent three phase motors and similar loads from operating backwards while being served by the generator.
D. Provide field supplies and installation of miscellaneous piping, wiring, loose shipped accessories, and other components for a turn-key and complete system. Example, provide field piping for non-ingestive crankcase ventilation system when required. Field coordinate pipe routing through the roof or side wall with manufacturer requirements and engineer.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00 and in compliance with NFPA 110 requirements.
B. Fill fuel tank prior to start of test.
C. The on-site installation test shall be conducted as follows:
    1. With the prime mover in a "cold start" condition and the emergency load at

standard operating level, a primary power failure shall be initiated by opening all switches or breakers supplying the primary power to the building or facility.

2. The test load shall be that load that is served by the Emergency Power Supply System (EPSS).
3. The time delay on start shall be observed and recorded.
4. Cranking time until prime mover starts and runs shall be observed and recorded.
5. The time taken to reach operating speed shall be observed and recorded.
6. The voltage and frequency overshoot shall be recorded.
7. The time delay on transfer to emergency power for each switch shall be recorded. Life safety and critical branch transfer switches must transfer within 10 seconds.
8. The time taken to achieve a steady-state condition with all switches transferred to the emergency position shall be observed and recorded.
9. The voltage, frequency, and amperes shall be recorded.
10. Prime mover oil pressure and water temperature shall be recorded, where applicable.
11. The battery charge rate shall be recorded at 5-minute intervals for the first 15 minutes and at 15-minute intervals thereafter.
12. When primary power is returned to building or facility, the time delay on retransfer to primary for each switch with a minimum setting of 5 minutes shall be recorded.
13. Time delay on the prime mover cool down period and shutdown shall be recorded.
14. Allow prime mover to cool for 5 minutes.
15. A load shall be applied for 4 hours total. The building load shall be permitted to serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate rating of the Emergency Power Supply (EPS), less applicable derating factors for site conditions. Observe and record load changes and the resultant effect on voltage and frequency.
16. The full load test shall be initiated immediately after the cooling time has expired by any method that starts the prime mover and, immediately upon reaching rated rpm, picks up 100 percent of the nameplate kW rating on one step, less applicable derating factors for site conditions.
17. During test, record the following at 5-minute intervals for the first 15 minutes and every 15 minutes for the rest of the test:
    a. Kilowatts
    b. Amperes
    c. Voltage
    d. Frequency
    e. Coolant temperature
    f. Enclosure temperature (interior)
    g. Oil pressure
    h. Engine exhaust temperature
    i. Engine inlet temperature
    j. Oil Temperature
    k. Battery charge rate
18. Upon completion of the test and after a cool down period, the crank/rest cycle shall be tested.
    a. Any method recommended by the manufacturer for the cycle crank test shall be utilized to prevent the prime mover from running.

b. The control switch shall be set at "run" to cause the prime mover to crank.
c. The complete crank/rest cycle shall be observed and recorded.

19. Test alarm and shutdown circuits by simulating conditions.

D. Contractor shall fill fuel tanks upon completion of test.

E. Testing documentation shall be submitted to the Architect/Engineer for review and approval. Reviewed documentation shall be submitted to IDPH as part of the project close-out certification package.

3.4 MANUFACTURER'S FIELD SERVICES

A. Prepare, start, test, and adjust systems under provisions of Section 26 05 00.

3.5 COMMISSIONING: ON-BOARD GENERATOR PARALLELING CONTROL

A. Prepare, start, test, and adjust systems under provisions of Section 26 05 00. The on-board paralleling startup, testing, and commissioning may be conducted with other startup, testing, and commissioning requirements of this specification.

B. Provide on-site manufacturer representative for on-board generator paralleling system startup, testing, and commissioning.

C. Simulate a utility power loss test of the EPSS and on-board generator paralleling control system.

1. Refer to the emergency power system sequence of operation schedule on drawings.
2. Report and document deviations from the sequence of operation schedule, system adjustments, and deficiencies.
3. Obtain and Submit Authority Having Jurisdiction AHJ observation and certificate of acceptable emergency power system operation when required for facility occupancy certificate.

3.6 ADJUSTING

A. Adjust generator output voltage and engine speed.

3.7 CLEANING

A. Clean work under provisions of Section 26 05 00.

B. Clean engine and generator surfaces. Replace oil and fuel filters.

3.8 DEMONSTRATION

A. Provide systems demonstration. Coordinate the demonstration schedule with the Owner and Architect/Engineer.

B. Describe loads connected to emergency and standby systems and restrictions for future load additions.

C. Simulate power outage by interrupting normal source and demonstrate that system operates to provide emergency and standby power.

END OF SECTION

SECTION 26 36 00 - TRANSFER SWITCH

PART 1 - GENERAL

1.1 SECTION INCLUDES
A. Automatic transfer switch with delayed transition [ATS-#]
B. Portable generator and load bank connection cabinet (GCC-#)
C. Remote annunciator for ATS [RA-ATS-#]

1.2 RELATED SECTIONS AND WORK
A. Refer to the Transfer Switch Schedule for rating and configuration.

1.3 QUALITY ASSURANCE
A. Manufacturer: Company specializing in automatic transfer equipment with three (3) years documented experience.

1.4 REFERENCES
A. NEMA ICS 1 - General Standards for Industrial Control and Systems
B. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers, and Assemblies
C. NEMA ICS 6 - Enclosures for Industrial Controls and Systems
D. NEMA ICS 10 - Guide to Application of Low-Voltage Automatic Transfer Switch Equipment
E. UL 1008 - Standard for Automatic Transfer Switches
F. NFPA 99 - Health Care Code
G. NFPA 110 - Standard for Emergency and Standby Power Systems

1.5 SUBMITTALS
A. Submit shop drawings and product data under provisions of Section 26 05 00.
B. Submit product data for transfer switches showing overall dimensions, electrical connections, electrical ratings, and environmental requirements.
C. Submit manufacturer's installation instructions under provisions of Section 26 05 00.

1.6 OPERATION AND MAINTENANCE DATA
A. Submit operation and maintenance data under provisions of Section 26 05 00.
B. Include instructions for operating equipment.
C. Include instructions for operating equipment under emergency conditions when engine generator is running.
D. Identify operating limits which may result in hazardous or unsafe conditions.
E. Document ratings of equipment and each major component.
F. Include routine preventive maintenance and lubrication schedule.
G. List special tools, maintenance materials, and replacement parts.

1.7 REGULATORY REQUIREMENTS
A. Conform to applicable code for emergency and standby electrical systems.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH WITH DELAYED TRANSITION
A. Automatic transfer switch, microprocessor controlled, three-position switch mechanism,

delayed transition, center position off capable for load shed, with local manual operation.

B. Acceptable Manufacturers, Standard Grade:
   1. Schneider Electric ASCO 300 Series
   2. Siemens Russelectric RMT Series
   3. Caterpillar CTG Series
   4. Cummins OTPC Series
   5. Generac W Series
   6. Kohler KCS/KCP Series

C. Description: NEMA ICS 2; automatic transfer switch.

D. Configuration: Electrically-operated, three-position delayed transition, center position off capable for load shed, mechanically-held transfer switch.

E. Control panel shall be micro-processor based.

2.2 PORTABLE GENERATOR / LOAD BANK CONNECTION CABINET (GCC-#)

A. Acceptable Manufacturers:
   1. ESL Power Systems Triple Switch Series
   2. Trystar

B. Wall mount, powder coat painted NEMA 3R housing with lockable door, 200 amps, 600 volt. Color-coded cam-lock connectors. Submit product data and dimensioned drawings. Color selection by Architect.
   1. Load Bank Cam Lock Receptacle: Female plug, male cable.
   2. Portable Generator Cam Lock Receptacle: Male plug, female cable.
   3. Cam Lock Configuration: Power flow from female to male; note ground / neutral configurations are opposite of phase conductors at the same connection location.

C. Interlock: Provide a kirk key or mechanical interlock between the permeant generator and the temporary generator disconnect.

D. Three-way Manual Transfer Switch: Provide-three-way switch to allow flexible connection between; onsite generator and load bank, portable generator and load, onsite generator and load. The switches may be transfer switch or circuit breaker technology.

E. Accessories: Provide the following required accessories.
   1. Generator Start Signals: Provide parallel generator start cabling from the transfer switches to the portable generator cabinet. Provide quick connect type connections for the generator start signals.
   2. Indicators:
      a. Generator "ON" indicator
      b. Utility "ON" indicator
      c. Phase Monitor: A-B-C phase rotation monitor indicator.
      d. Cabinet Heater: Provide cabinet heater with thermostat/humidistat sized per manufacturer recommendations to prevent condensation inside cabinet. EC to provide branch circuit wiring per approved shop drawings.

F. Provide engraved plastic label including:
   1. System voltage
   2. Maximum amps
   3. Short Circuit Current Rating SCCR
   4. Phase rotation direction
   5. Phase, ungrounded conductor, and grounding identification

2.3 AUTOMATIC SEQUENCE OF OPERATION

A. Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.
B. Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.
C. Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.
D. Time Delay Before Transfer to Alternate Power Source: 0 to 30 seconds, adjustable.
E. Initiate Retransfer Load to Normal Source: Upon permission by normal source monitor.
F. Time Delay Before Transfer to Normal Power: 0 to 30 minutes, adjustable; bypass time delay in event of alternate source failure.
G. Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, of unloaded operation.

2.4 REQUIRED ACCESSORIES

A. The following accessories, features, and characteristics shall be provided with each automatic style transfer switch.
B. Load Shed:
    1. Controller shall be capable of being programmed to automatically shed the connected load from the generator in the event of a user configurable under- frequency, under-voltage or overload condition. Under-frequency shedding shall occur if generator is less than 58Hz for greater than 3 seconds or less than 50 Hz for greater than 0.5 seconds.
    2. Switch shall be configurable to pick up an output status relay upon activation of the auto load shed feature. Output shall be usable to trip/isolate downstream loads in the event of an overload.
    3. Reset of the auto load shed function shall be via operator reset on display, remote reset contact input, or via network signal.
C. Indicating Lights: Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.
D. Test Switch: Key operated or password protected switch. Mount in cover of enclosure to simulate failure of normal source.
E. Engine Start Signal: Rated 10 amps at 30VDC shall be provided to start the engine generator in the event of a normal source outage.
F. Remote Start Circuit Monitoring: Provide continuous monitoring of the generator start circuits. A failure shall initiate visual and audible alarms at the generator, remote annunciators, and start the generator.
G. Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.
H. Transfer Switch Auxiliary Contacts: 2 normally open; 2 normally closed indicating switch to normal source or emergency source.
I. Normal Source Monitor: Monitor each line of normal source voltage and frequency; initiate transfer when voltage drops below 85 percent or frequency varies more than 3 Hertz from rated nominal value, values shall be field adjustable.
J. Alternate Source Monitor: Monitor each line of alternate source voltage and frequency; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 percent Hertz from rated nominal voltage, values shall be field adjustable.
K. Engine Exerciser: Start engine every 7 14 28 days. Run for 30 minutes before shutting down. Each event shall be configurable for Test with Load or Test Without Load.

Bypass exerciser control if normal source fails during exercising period.

L. In-Phase Monitor: Inhibit transfer until source and load are within 30 electrical degrees.

M. Provide 2 N.O. and 2 N.C. isolated contacts to indicate:
   1. Normal source available.
   2. Emergency source available.
   3. Exercise mode in operation.

N. Communication Port: Communication cable in conduit shall daisy chain all transfer switches with a remote annunciator.

2.5 SCHEDULED ACCESSORIES

A. The following accessories, features, and characteristics shall be provided when scheduled. Refer to the transfer switch schedule and plan drawings for additional information.

B. RA-ATS-# Remote Annunciator: A remote annunciator shall be provided that shall monitor and control the following functions for each transfer switch:
   1. Load Connect to Emergency/Normal Indication
   2. Source Available: Emergency/Normal Indication
   3. Time Delay Indication and Key Locked Bypass Switch
   4. Transfer Test Indication and Key Locked Switch
   5. Remote transfer loads between normal and emergency sources with Key Locked Switch
   6. Remote generator start with Key Locked Switch
   7. Remote generator stop with Key Locked Switch
   8. Annunciators shall be located as directed by the Owner. Extend conduit and wire as required by the manufacturer.
   9. An adjustable emergency to normal pre-signal signal to elevator controller.

C. Metering Capabilities: The following metered readings shall be available at the local display.
   1. Current, per phase RMS and neutral
   2. Current unbalance %
   3. Voltage, phase-to-phase and phase-to-neutral
   4. Voltage unbalance %
   5. Real power (KW), per phase and 3-phase total
   6. Apparent power (KVA), per phase and 3-phase total
   7. Reactive power (KVAR), per phase and 3-phase total
   8. Power factor, 3-phase total & per phase
   9. Frequency
   10. Accumulated energy, (KWH, KVAH, and KVARH)
   11. Demand, (KWH, KVA)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify surfaces are ready to receive work.

B. Verify field measurements are as instructed by the manufacturer.

C. Verify required utilities are available, in proper location, and ready for use.

D. Beginning of installation means acceptance of existing conditions.

3.2 CONTROL AND SIGNAL CABLING

A. Provide control and signal cabling per manufacturer recommendations for the following systems components:
   1. Remote annunciator.
   2. Elevator controller. Provide wiring to elevator controller for emergency source mode and emergency to normal pre-signal.
   3. Generator start signal. The generator start signal cabling for the following transfer switches shall be fire protected for a minimum of 2 hours using an approved method:
      a. Emergency, legally required, optional standby transfer switches
      b. Approved Methods:
         1) Raceway or cable encased in a minimum of 2 inches of concrete cover.
         2) Listed fire resistive raceway / cable system.
         3) Raceway / cable is protected by a listed electrical circuit protective system.

3.3 INSTALLATION

A. Install in accordance with manufacturer instructions.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, and elevators.

1.2 QUALITY ASSURANCE

A. Specified unit shall be designed, manufactured, tested and installed in compliance with the above references. Unit shall be "Listed by Underwriters Laboratories" to UL 1449.

B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.3 REFERENCES

A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components

B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components

C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices

F. CBEMA - Computer Business Equipment Manufacturers Association

G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage

H. NFPA 70 - National Electrical Code (NEC)

I. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors

J. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.4 SUBMITTALS

A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty & Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without testing data as required by section this section will be rejected.

1.5 SPARE PARTS

A. Surge Protection Modules: Furnish [1] replacement module for each type installed.

1.6 TESTING, WARRANTY AND LIFE EXPECTANCY

A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.

1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

B. Minimum Repetitive Surge Current Capacity:
1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
2. Minimum Repetitive Surge Current Capacity Test:
   a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.
   b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
   c. To complete the test, another UL 1449 surge shall be applied to verify the unit survival.
3. Survival is achieved if suppression voltage (VPR) does not vary by more than 10%.
4. Proof of such testing shall be the test log generated by the surge generator.

C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.

D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.2 RATINGS

A. Service Entrance Suppressors:
1. For 120/208-volt, 3 phase, 4 wire, type 2, category C3 unit.
   a. Surge current capacity 80,000/160,000 amps per protection mode/phase
   b. Nominal Discharge Current: 20 kA.

c. Mounting: Refer to the drawings.
d. Voltage Protection Rating: Refer to requirements below.
e. Components: Minimum component size of 20mm thermally protected metal oxide varistors (MOV).
f. Disconnect: Surge-rated disconnect with 200,000 SCCR.

2. Manufacturers:
a. Square D Surgelogic EMA Series
b. Siemens TPS4 Series
c. Eaton SPD Series
d. Current Technology Current Guard Plus
e. ASCO Power Technologies 400 Series
f. LEA International LSS Series

B. Secondary Distribution Suppressors:
1. For 120/208-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.
a. Surge current capacity: 60,000/120,000 amps per protection mode/phase
b. Nominal Discharge Current (IN): 20 kA.
c. Mounting: Refer to the drawings.
d. Voltage Protection Rating: Refer to requirements below.
e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).

2. Manufacturers:
a. Square D Surgelogic EMA Series
b. Siemens TPS4 Series
c. Eaton SPD Series
d. Current Technology Current Guard Plus
e. ASCO Power Technologies 400 Series
f. LEA International CFS Series

C. Voltage Protection Rating:
1. Protection modes and UL 1449 voltage protection rating for surge suppression units per each mode (L-N, L-L, L-G, and N-G as appropriate).
a. 120/208 Volt, 3 phase, 4 wire. 700 Volt L-N, N-G, 800 Volt L-G and 1200 Volt L-L

D. Indication:
1. Each unit shall include solid-state indicators with externally mounted LED visual status indicators that indicate on-line status of each protection mode of the unit.
2. Each unit shall include a visual indicator that indicates the unit is functioning properly and providing protection.
3. Each unit shall include an audible alarm with silencing switch to indicate when protection has failed.
4. Provide each service entrance, secondary distribution type unit(s) with a transient counter.
5. Each unit shall contain form "C" contacts for remote indication of an alarm status.

E. Fuses:
1. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit.
2. Fuses shall be rated 200, 000 AIC minimum interrupting capacity.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.

B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.2 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the switchboard, panel secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the switchboard panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.

B. Connections:

1. Contractor shall provide wire and circuit breakers sized per the approved manufacturer requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".
2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard. Single phase 120-volt units shall be hardwired without a disconnecting means.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. Additional Locations: Critical Load Protection - Fixed Equipment (120 Vac):

1. Install an A3 hard-wired surge protection device between each of the following equipment items and its power supply conductors.
   a. Fire alarm master panel
   b. Required at elevator disconnect when scheduled to operate on emergency power.
   c. Elevator control panel

D. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.

END OF SECTION

SECTION 26 51 19 - LED LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories
B. LED emergency lighting units
C. Emergency exit signs
D. Emergency inverter for LED light engines (individual luminaires - integral)

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:
   1. 26 09 33 Lighting Control Systems
      a. Automatic load control relay (ALCR) (individual luminaire - integral) (ALCR3)
   2. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 REFERENCES

A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products
B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement
C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
D. NFPA 70E - National Electrical Safety Code
E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System
F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products
G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products
H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED
I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)
J. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.
B. Basic Requirements of Submittal:
   1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire, LED light engine, driver, or pole information following luminaire product data. Failure to organize submittal in this manner will result in the submittal being rejected.

2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.
4. Submit manufacturer origin of LED chipset and driver.

C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):
1. IESNA LM-79: Include photometric report for latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.

D. LED Lighting - Control Compatibility Submittal:
1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

E. Submit utility rebate forms where offered at project location. Submit completed rebate forms within 30 days of Substantial Completion.

1.5 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 05 00.

B. LED Light Engines or Modules: percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.

C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.

D. LED Drivers: Insert percent of quantity installed, minimum one (1) of each size and type.

E. Exit Signs: Provide 8 **a**dditional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 05 00.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.7 WARRANTY

A. The warranty period begins at the date of Substantial Completion.

B. LED Light Engines and Drivers:
1. LED Drivers and Dimming Drivers: Five (5) years
2. Light Emitting Diode (LED) Light Engines: Five (5) years

C. Emergency Lighting Units and Exit Signs:
1. Emergency Lighting Units: Three (3) year, non-prorated
2. Exit Signs: Three (3) year, non-prorated
3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell,

requiring no maintenance or replacement for ten (10) years under normal conditions.

D. Emergency Drivers:
   1. Emergency LED Driver: Three (3) years
E. Automatic Load Control Relay (ALCR): Five (5) year

1.8 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.
B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.
C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.
D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.
E. Painted reflector surfaces shall have a minimum reflectance of 90%.

2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.
B. Provide low temperature LED drivers, with reliable starting to -20°F.
C. In-grade luminaires shall have lamp/optic separation to prevent surface temperature from exceeding 115°F. Compartment separation of wire entry and control gear/lamp chamber.
D. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.3 LED EMERGENCY LIGHTING UNITS

A. Self-Powered Emergency Lighting Units: One-piece, self-contained unit with sealed, maintenance-free nickel cadmium battery, automatic charger and electronic circuitry. Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
B. Battery: Maintenance free lead calcium type, with[90][120] minute capacity to supply the connected lamp load.
C. Charger: Dual-rate solid state current limiting charger, capable of maintaining the battery in a full-charge state during normal conditions, and capable of recharging discharged battery to full charged within 168 hours. Low voltage disconnect to prevent deep discharge of battery.

D. LED Lamp Wattage: As scheduled on luminaire schedule.
E. Remote Lamps: Match LED lamps on unit.
F. Indicators: Provide lamps to indicate AC ON and RECHARGING. Provide voltmeter.
G. Provide test switch to transfer unit from normal supply to battery supply.
H. Electrical Connection: Knockout for conduit connection.
I. Unit Voltage: Refer to luminaire schedule volts, AC.
J. Self-Diagnostics and Testing:
    1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
    2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five-minute discharge/diagnostic test at any time.

2.4 EMERGENCY EXIT SIGNS

A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings and schedule.
B. Self-Diagnostics and Testing:
    1. Unit shall be self-diagnostic with continuous monitoring of charger performance and battery voltage. Any malfunction of battery, charger, transfer circuit, or emergency lamps shall be detected and visually indicated.
    2. Unit shall be programmed to exercise the battery and test emergency operation by performing a five-minute discharge/diagnostic cycle every six months. A manual test switch shall allow a five minute discharge/diagnostic test at any time.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.
B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.
C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.
D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.
E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (Cc) of 0.67. Design vertical supports with a factor

of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.

F. Install lamps in lamp holders of luminaires.

G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

H. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.

3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

A. Contractor shall provide temporary construction lighting per requirements of Division 1.

B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.3 AUTOMATIC LOAD CONTROL RELAYS

A. Factory or field installation per manufacturer requirements.

B. Remote Test Switch: Provide connection to remote test switch.

C. Fire Alarm Override: Provide connection to addressable fire alarm relay.

3.4 EMERGENCY LIGHTING UNITS AND EXIT SIGNS

A. Install units plumb and level.

B. Aim directional lamp heads as directed.

C. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion. Provide electronic copy of periodic test log form to Owner Representative. Explain and instruct Owner Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing & logging requirements.

3.5 RELAMPING

A. Replace failed LED light engine modules or arrays at completion of work.

3.6 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

3.7 OWNER TRAINING

A. Test emergency lighting equipment for 60 minutes to determine proper operation, prior to Substantial Completion, with the Owner Representative.

B. Provide electronic copy of periodic test log form to Owner Representative. Explain and instruct Owner Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.8 LUMINAIRE SCHEDULE

A. As shown on the drawings.

END OF SECTION

SECTION 28 31 01 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire alarm and detection systems.

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.

B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 3. This person's name & certification number shall appear on the start-up and testing reports.

1.4 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators

B. NFPA 70 – National Electrical Code (NEC)

C. NFPA 72 - National Fire Alarm and Signaling Code

D. NFPA 101 - Life Safety Code

E. UL 2017 - General Purpose Signaling Devices and Systems

F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

G. 2020 Fire Code

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.

1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.

B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for <u>each</u> variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.

3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:
1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 26 05 00.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

H. Submit photocopy proof of NICET certification of the person overseeing the preparation of drawings and installation/testing.

1.6 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.
a. Notification Appliances: Speakers, speaker strobes, and strobes.
2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet and shall turn over to the Owner upon completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Store and protect products under provisions of Section 26 05 00.

1.8 REGULATORY REQUIREMENTS

A. System: UL or FM Global listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.9 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, control panels, auxiliary control devices, annunciators,

power supplies, and wiring as indicated on the drawings and specified herein.

C. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

D. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

E. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.

F. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.

G. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.10 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 26 05 00.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.11 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 05 00.

B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer's representative's letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.12 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Johnson Controls - Simplex

B. Notifier by Honeywell

C. Edwards - EST
D. Siemens Fire Safety
E. Gamewell - FCI

2.2 FIRE ALARM CONTROL PANEL (FAP)

A. Control Panel: Modular, power-limited electronic design. Provide flush surface wall-mounted enclosure as shown on plans. Enclosure shall be minimum 0.060 steel with provisions for electrical conduit connections into the sides and top. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators.

B. Each Signaling Line Circuit (SLC loop) shall not be loaded over 80% of the maximum device capacity. For example, in the minimum system capacity column listed below, if the fire alarm manufacturer's system capacity of analog sensors per loop is 99 devices, then no more than 79 devices shall be wired on that loop. The minimum system capacity shall be as follows:
   1. Panel Expansion Capability, Minimum Total SLC Loops: 10
   2. Minimum Node Capacity for Network System: 100

C. Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC) Boards:
   1. Each board shall communicate directly with each addressable analog sensor and binary input to determine normal, alarm, or trouble conditions. Analog signals would be used for automatic test and determination of maintenance requirements.
   2. Each board shall contain its own microprocessor and shall be provided to monitor addressable inputs and to control addressable outputs (addressable relays). The board shall communicate and provide power to all devices on its loop over a single pair of wires, except where 4-wire devices require a separate power circuit.
   3. Pathway class: slc for addressable devices with less than 50 devices can be class a or b, and more than 50 devices shall be class a.
   4. Shared pathway designation level 1: physical segregation of life safety and non-life safety data is not required. Life safety data shall be the priority.

D. Central Processing Unit:
   1. The central processing unit (CPU) shall communicate with the monitor and control all other modules in the panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the CPU.
   2. The CPU shall execute all control-by-event programs for specific action to be taken if a designated situation is detected in the system. A real-time system clock for time annotations on the display and printer shall be included.
   3. All power for the unit shall be supervised and supplied by the FAP.

E. Display:
   1. The board shall provide all controls and indicators used by the system operator and may also be used to program all control panel parameters.
   2. The board shall provide an alphanumeric array for display of custom alphanumeric labels for all addressable points. It shall also provide indicators for AC Power, System Alarm, System Trouble, Display Trouble and Signal Silence.
   3. Displayed descriptions of addressable points shall include actual room names/numbers selected by the Owner. This information shall be obtained prior to programming. Room names/numbers shown on floor plans shall not be used.
   4. The board shall provide a touch keypad with control capability to command all

system functions and entry of any alphanumeric information. Twenty different passwords with four levels of security shall be supported to prevent unauthorized manual control or programming.

F. Power Supply:
   1. Input power shall be 120 VAC, 60 Hertz. Output power shall be as noted on the device specifications and drawings. Each component of the fire alarm system requiring 120 VAC input power shall be served from a dedicated **emergency life safety** branch circuit. Provide two #12 conductors and one #12 ground in 3/4" conduit to a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Identify/label breaker and branch circuit in accordance with NFPA requirements and Specification Section 26 05 53.
   2. Adequate to supply 125% of all control panel and peripheral power needs as well as 125% of power required for all external audio-visual devices. The power supply may be increased as needed by adding additional modular expansion power supplies. Over-current protections shall be provided on all power outputs.
   3. All power supplies shall be designed and installed to meet UL and NFPA requirements for power-limited operation on all external initiating and indicating circuits.
   4. Power supply shall provide integral charger for use with internal batteries. Battery capacity shall be sufficient for operation of entire system for 24 hours in a non-alarm state followed by alarm mode for 15 minutes, plus 25% spare capacity for future devices.

G. Surge Protection:
   1. All fire alarm control panels, NAC panels, etc. shall be provided with a surge protection device (SPD). The SPD shall be UL listed to Standard 1449 Rev 3. The unit should be clearly labeled in accordance with Identification Section 26 05 53. The SPD shall have thermal fuses to protect against fire in short circuit conditions. The unit shall provide visual indication that the unit is protecting and functioning.
   2. Any communications or signaling circuits associated with the fire alarm system, which leave or enter a facility, shall be provided with a surge protection device. The devices shall be as recommended by the fire alarm system manufacturer.

H. Dual Digital Communicator:
   1. Provide dual phone line interface capable of fire alarm notification to the local fire department, fire protection agency, or monitoring service. Communicator shall report in SIA and most major communication formats, with the capability of transmitting each device address point in a format compatible with the central station receiver.
   2. Monitoring fees and initial connection charges are not part of this project.
   3. Communicator shall be fully supervised and shall operate on loop start phase lines ahead of the building PBX system.
   4. Communicator shall be FCC registered. Contractor shall provide two RJ31X jacks.
   5. Approvals: UL listed - UL 864/NFPA 72, FM approved.
   6. Communicator shall be provided integral to the fire alarm panel as furnished by the fire alarm panel manufacturer. If the panel construction requires a separate unit, unit shall be as manufactured by Silent Knight, Ademco, or fire alarm panel manufacturer approved equal.

2.3 SIGNALING LINE CIRCUIT DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable.

Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):
   1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. Device type as follows:
         1) W = Weather Proof
         2) WG = Wire guard is required
         3) Candela Ratings:
            a) NICET designer shall select Candela rating as required to provide full coverage of the space.
      b. Sequence of operation as follows:
         1) E = Elevator Recall
         2) D = HVAC Control

C. FA-130; Manual Pull Stations:
   1. Manual pull station, addressable, double action with plastic breakrod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provided with all necessary mounting hardware. Use surface mount only on precast concrete or structure.
   2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.
   3. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location, with maintained temperatures between 32°F and 120°F.

D. FA-140; Heat Detectors:
   1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. Device types as follows:
         1) Blank = Combination Rate of Rise / Fixed Temp
         2) AT = Attic (located in)
         3) F = Fixed Temp
         4) RC = Rate Compensated
         5) X = Explosion Proof
   2. (BLANK) Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
   3. (F) 200°F fixed temperature. Provide a remote addressable monitor module to interface with addressable system as shown on the plans.
   4. (RC) Rate Compensated
   5. Provide a two-piece head/base design, with a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
   6. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor

all detectors in one room/area as shown on the drawings.

7. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
8. Provide a remote LED indicator device if detector is not visible from a floor-standing position.
9. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. A connection for attachment of a remote indicator shall be provided.
10. A test means shall be provided to simulate an alarm condition.
11. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

E. FA-160; Monitor Modules:
   1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. Device types as follows:
         1) Blank = Refer to Plans
         2) KB = Knox Box Monitor
   2. Monitor Module shall connect directly to SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with control panel using Style D or Style B circuits. Contractor Option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
   3. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
   4. The module shall supply the required power to operate the monitored device(s).
   5. Module shall provide address setting means using rotary decimal or DIP switches.

F. FA-161; Addressable Control Module:
   1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. Device types as follows:
         1) Blank = Refer to Plans
         2) DH = Door Hold Open
         3) PD = Hold Open Override
   2. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
   3. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
   4. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
   5. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.4 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):
   1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. Device types as follows:
         1) W = Weather Proof
         2) WG = Wire guard is required
         3) Candela Ratings:
            a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela
            b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

C. Notification Device(s):
   1. Wall Mounted: Red housing with red lettering or pictogram.
   2. Ceiling Mounted: White housing with red lettering or pictogram.

D. FA-200; Visual Alarm Devices:
   1. Wall or ceiling mounted, refer to plans.
   2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
   3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
   4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
   5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.
      a. Mounting: Semi-flush wall.
      b. Conduit shall not be exposed.

2.5 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)

A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.

B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.

C. Power for each NAC shall be from a local 120 VAC circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with the Architect/Engineer prior to installation.

D. NAC extender panels may be installed only in locations coordinated with Architect/Engineer.

E. Mounting: Flush Surface.

2.6 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

A. FA-260; Flow Switch:
   1. (FA-260) Connection to flow switch to monitor fire protection flow switch or discharge output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
   2. Provide a dedicated monitor switch for each sprinkler flow switch.

B. FA-261; Tamper / Monitor Switch:
   1. (FA-261) Connection to monitor switch to monitor fire protection system supervisory switches or output contacts. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC.
   2. Tamper switches in the same room or system may be monitored by a single monitor switch when shown grouped on the plans.
   3. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
   4. Device types as follows:
      a. Blank = Refer to Plans
      b. PIV = Post Indicator Valve
   5. (PIV) Post Indicator Valve. Connection to post indicator valve for sprinkler system supervisory notification. Normally open dry contacts for fire alarm interface. Furnished and installed by MC; wired by EC. Provide surge protection device as recommended by the fire alarm system manufacturer online entering/leaving the facility.

C. FA-161; Lighting Control Override:
   1. Subscript: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. LC = Lighting Control Override
   2. The lighting control system(s) is equipped with a remote input fire alarm override contact to allow the fire alarm system via an output relay to override the lighting control sequence of operation upon a fire alarm "alarm" condition. The fire alarm system will provide addressable fire alarm output relay(s) to interface with the lighting control system. Coordinate the location and quantity of relays required with the lighting control system.
   3. Provide (FA-161) fire alarm addressable control module for each interface required for the lighting control system.

D. FA-160; Knox Box Monitor:
   1. Subscript: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
      a. KB = Knox Box
   2. Monitored Knox box furnished and installed by GC. Provide addressable monitor module (FA-160) for Knox box monitoring. Refer to architectural plans for requirements and location.

2.7 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in

accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:
   1. Manufacturers:
      a. Comtran Corp.
      b. Helix/HiTemp Cables, Inc.
      c. Rockbestos-Suprenant Cable Corp.
      d. West Penn Wire/CDT.
      e. Radix.

PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

A. General:
   1. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

B. Panel/Annunciator Alarm, Trouble, Supervisory Indication:
   1. Appropriate system Alarm, Trouble, or Supervisory LED shall flash at the control panel, transponder, and annunciator locations.
   2. A local signal in the control panel shall sound.
   3. The LCD display shall indicate all information associated with the condition, including the name of the item, type of device and its location within the protected premises.
   4. history storage equipment shall log the information associated with the fire alarm control panel (FAP) condition, along with the time and date.
   5. Transmit the appropriate signal (supervisory, trouble, alarm) to the central station via the digital communicator.
   6. Transmit the appropriate signal (supervisory, trouble, alarm) to the building automation system via addressable relays tied to contact monitors on the system.

C. Audible Alarms Sequence:
   1. Audible alarms throughout the building shall sound.

D. Visual Alarms Sequence:
   1. Visual alarms throughout the building shall flash.

E. Nurse Station Annunciation Sequence:
   1. Fire alarm system shall provide annunciation of device and room in alarm at fire alarm annunciator located at the nurse station serving the patient room in alarm.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Fire Alarm Control Panel:

C. Devices:
   1. General:
      a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected

floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.

b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.

c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.

d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall adjust location of device so new location meets all requirements in NFPA 72 and all applicable building codes.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.

3. Protection of Fire Alarm System:
   a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.

4. Manual Pull Stations:
   a. Stations shall be located where shown and at the height noted on drawings.

5. Addressable Relays and Monitor Modules:
   a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
   b. All modules shall be mounted in or on a junction box in an accessible location.
   c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

6. SLC Loop Isolation Modules:
   a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.
   b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings. Refer to the fire alarm riser diagram for requirements. Refer to the floor plans for areas served by separate isolation modules.

7. Notification Appliance Devices:
   a. Devices shall be located where shown on the drawings.
   b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
   c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they

shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.

D. Wiring:
   1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
   2. Wiring shall be installed in conduit.
   3. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.
   4. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
   5. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.
      a. Fire alarm temporal audible notification for all audio appliances.
      b. Synchronization of all visual devices where two or more devices are visible from the same location.
      c. Ability to silence audible alarm while maintaining visual device operation.
      d. Emergency communication alert and textual visible appliance notification.
   6. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

E. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.
   1. Power Branch Circuit Conductors: In accordance with Section 26 05 53.
   2. Signaling Line Circuit: Overall red jacket with black and red conductors.
   3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
   4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.
   5. Door Release Circuit: Gray conductors.
   6. Central Station Trip Circuit: Orange conductors.
   7. Central Station Fire Alarm Loop: Black and white conductors.

F. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

G. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of Code.

C. Contractor shall test and adjust the fire alarm system as follows:
   1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:
      a. 70dBA.
      b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
      c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
      d. As specified on the drawings.
   2. Sound level measurement procedure shall meet the following requirements:
      a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
      b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
      c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
      d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
      e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
      f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of two (2) rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
      g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.

3.4 MANUFACTURER FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 26 05 00.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

D. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, four (4) hours each visit, outside normal occupancy hours.

END OF SECTION